Railway Engineering and Maintenance

RAILWAY ENGINEERING AND MAINTENANCE
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Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

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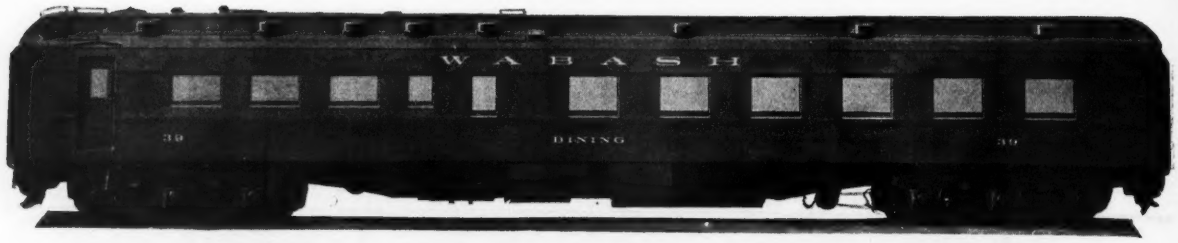
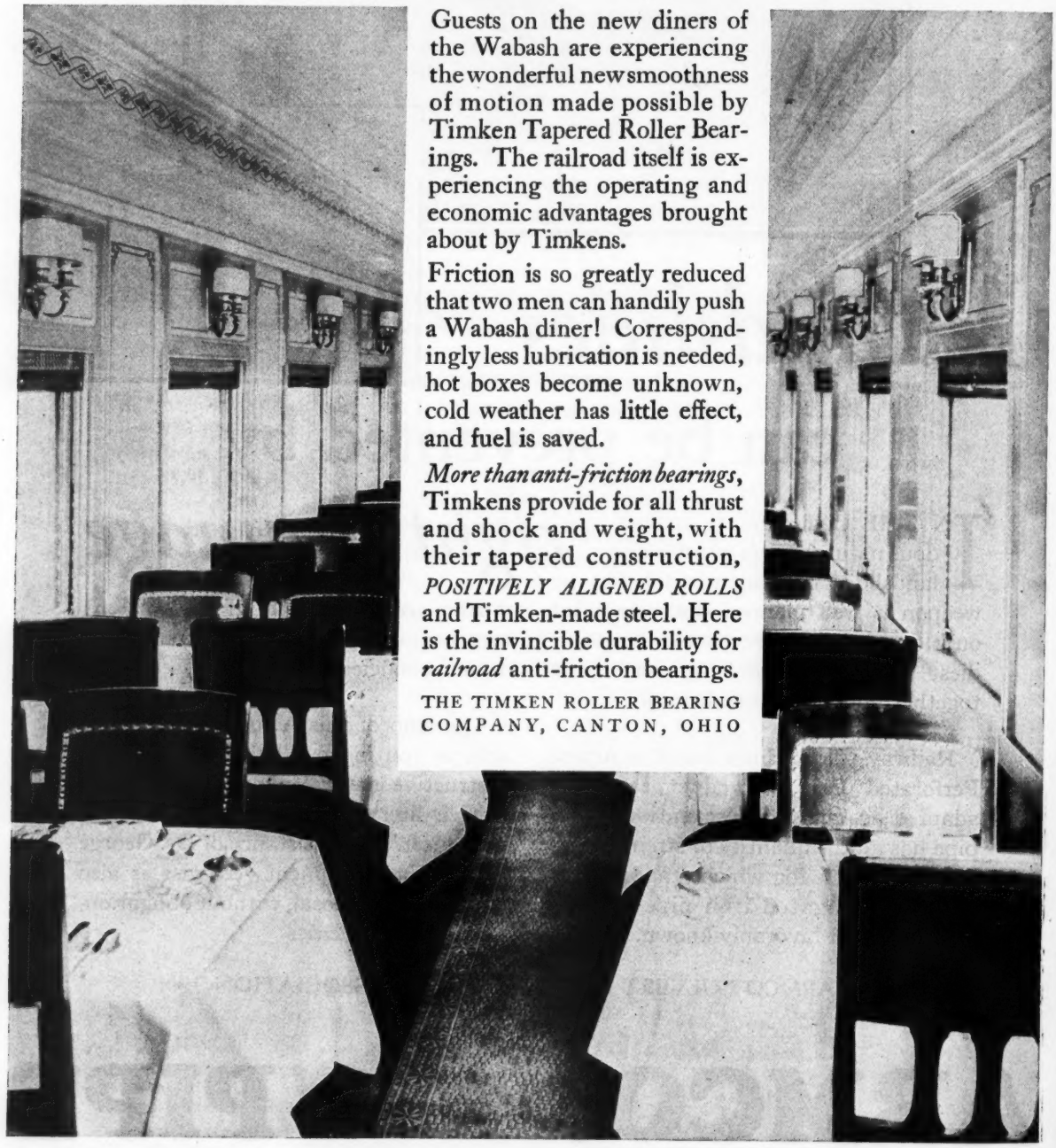


Timken Bearings on the Wabash



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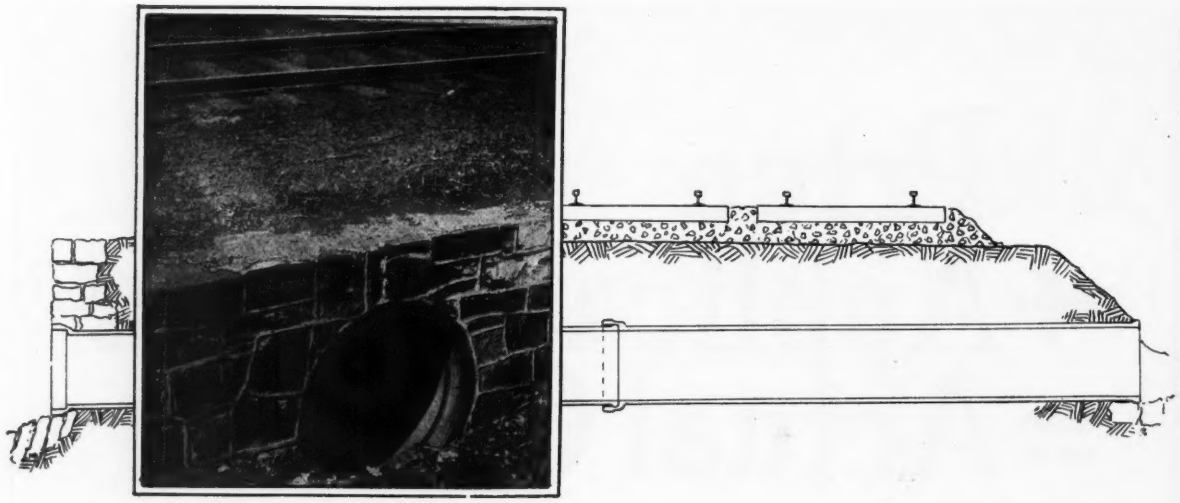

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This tank was pitted and out of service, ready for the junk man in 1923. Less than $10.00 worth of NO-OX-ID put it back into service, and is still giving protection, while a new tank costs $1500.00.

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A test will convince

Woodings Forge & Tool Co.

Works and General Sales Office

Verona, Pa.

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Holding tool with anchor in groove, it is placed under rail close to tie with hook end over rail edge.

By pulling down on tool, the anchor snaps on readily.

Anchor holds by its own resiliency.

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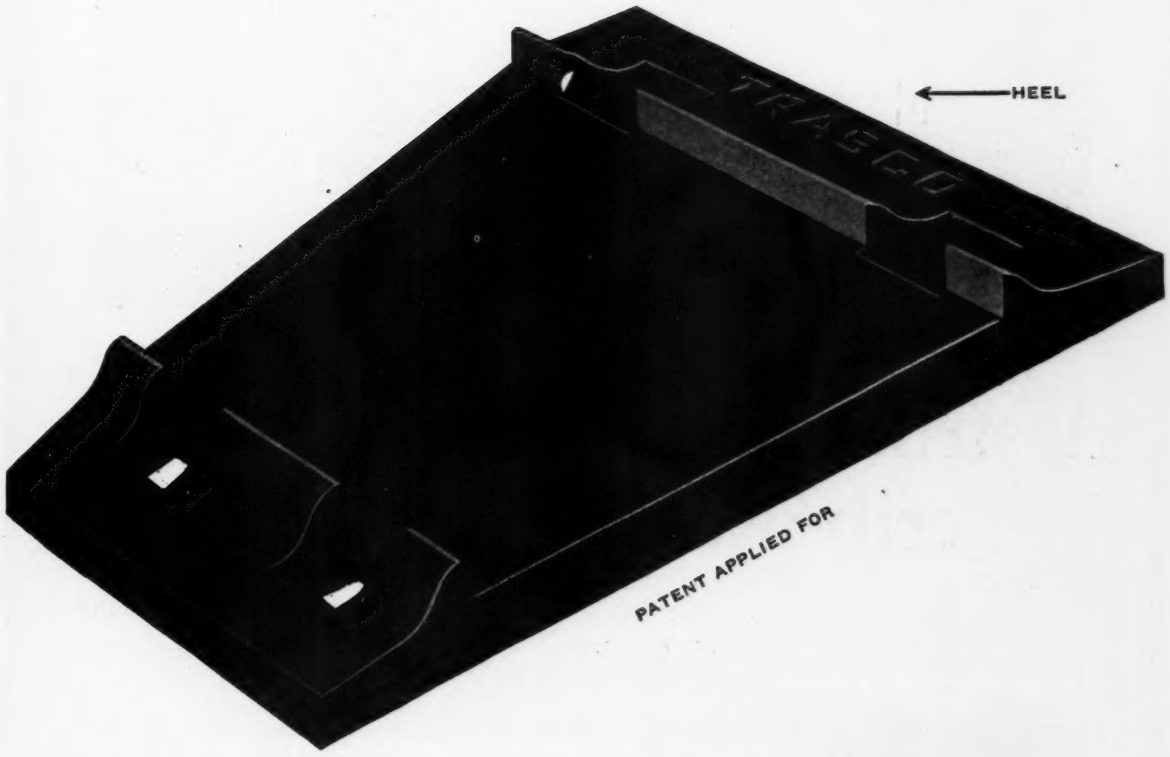
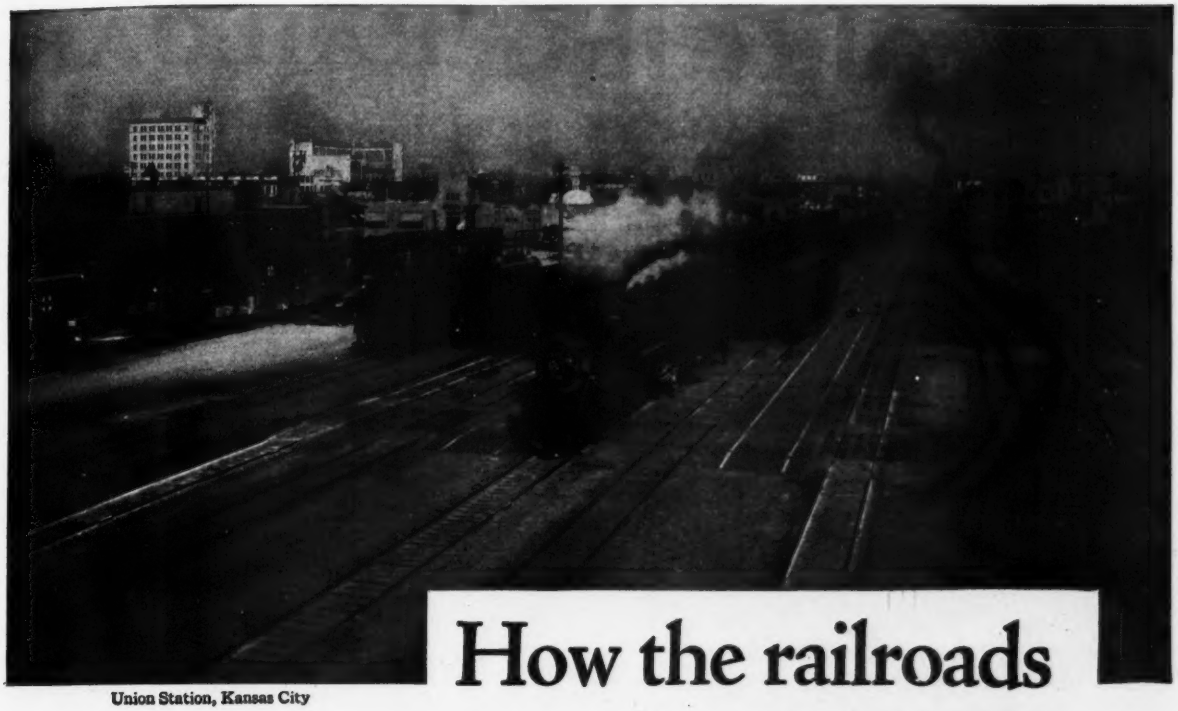
TRAPEZOIDAL TIE PLATE

"Always On The Level"



This plate doesn't take a heel dive into the tie

Write us for data and prices



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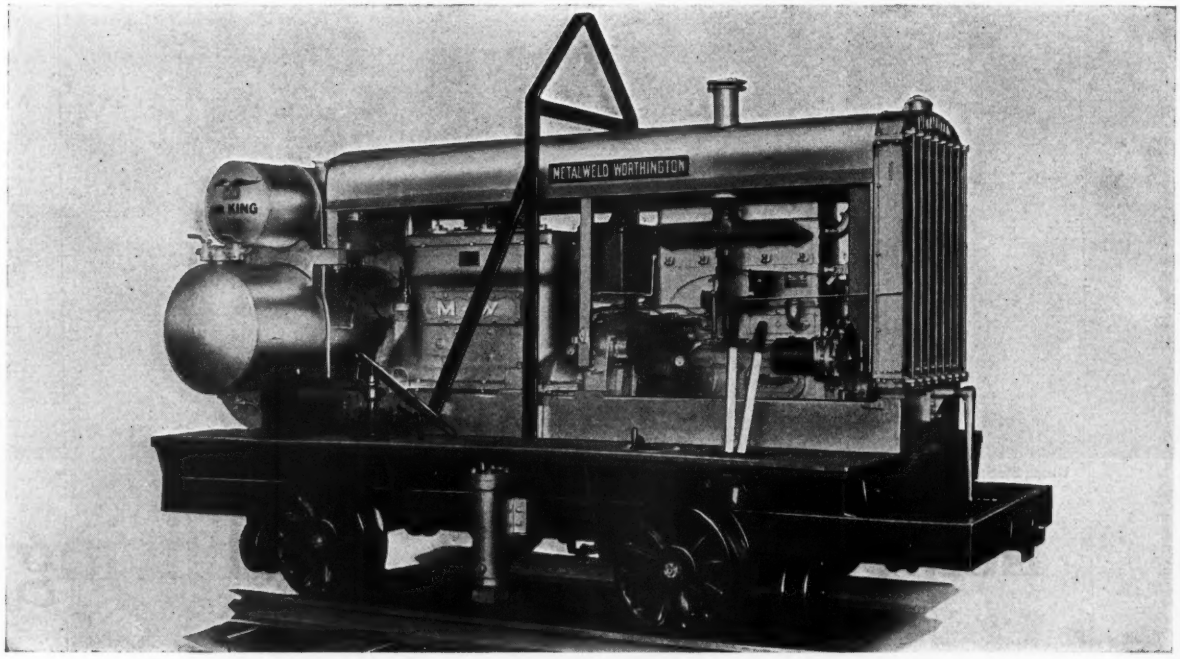

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1 —3-cylinder Worthington Compressor, direct connected to engine. No gear reduction nor clutches.

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3 —Full force-feed lubrication throughout engine and compressor.

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Safeguards against mechanical wear, lowers maintenance costs and assures maximum return from your investment in ties and cost of treatment.

The Lundie Engineering Corporation
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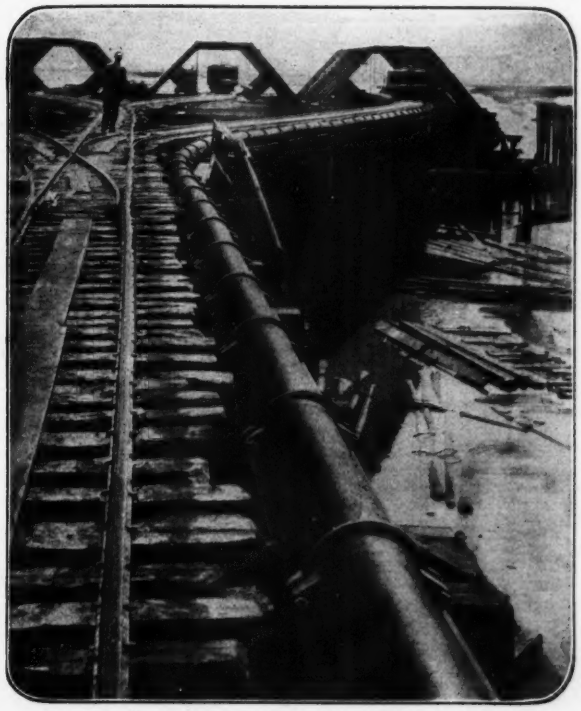
LUNDIE TIE PLATE



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THE CENTRAL FOUNDRY COMPANY

Subsidiary of The Universal Pipe and Radiator Company

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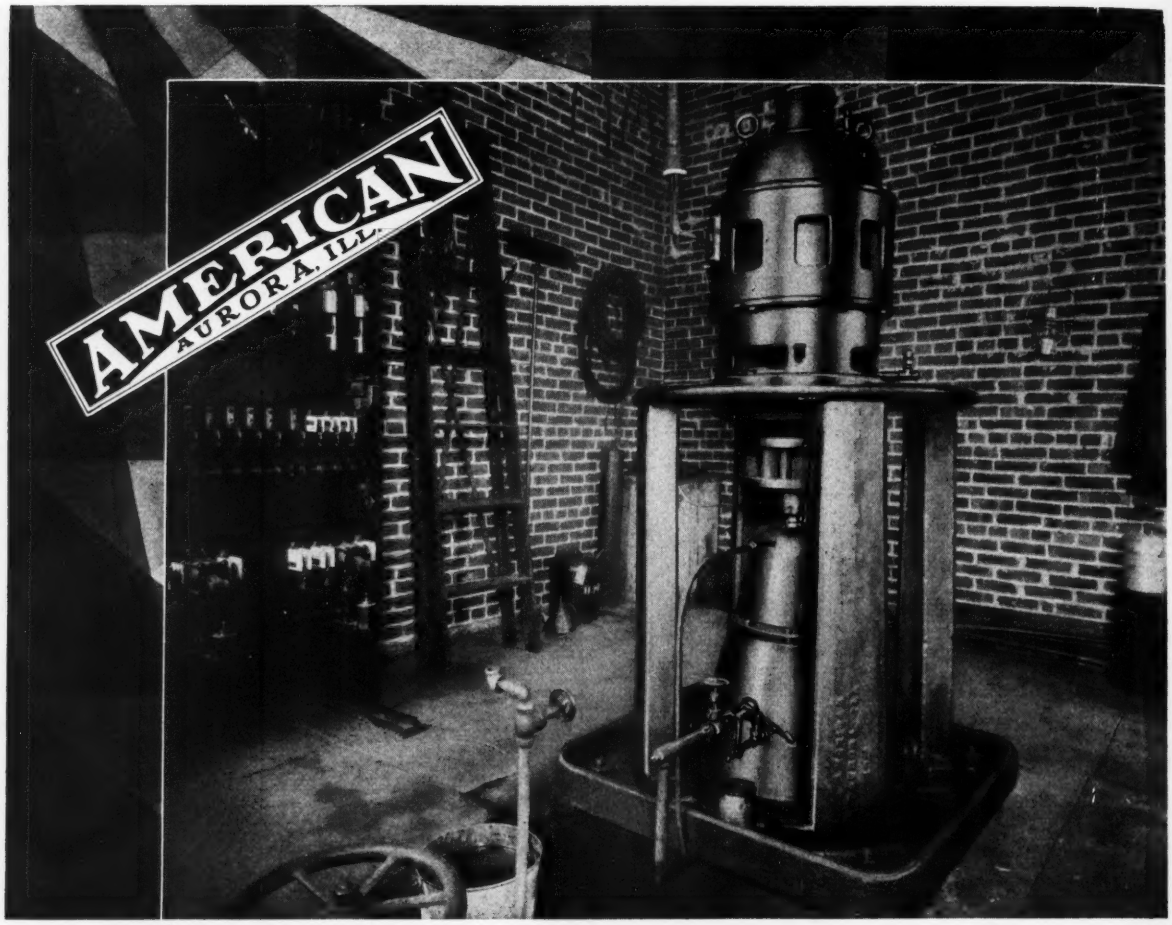

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The "American" trade mark, with its guarantee of satisfactory performance, may be found on the pump equipment of many of the leading railroads of the country.

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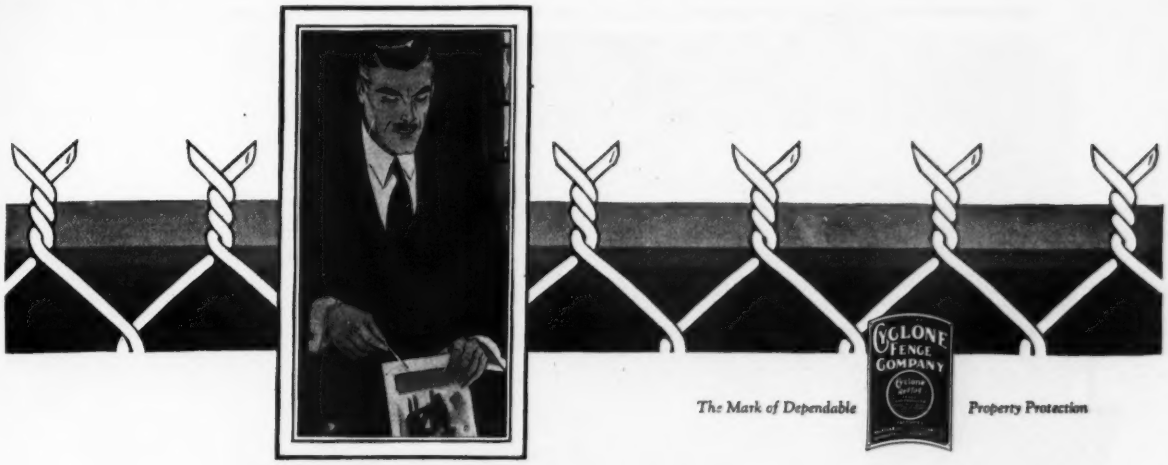
General Offices AURORA, ILLINOIS *and Factory*



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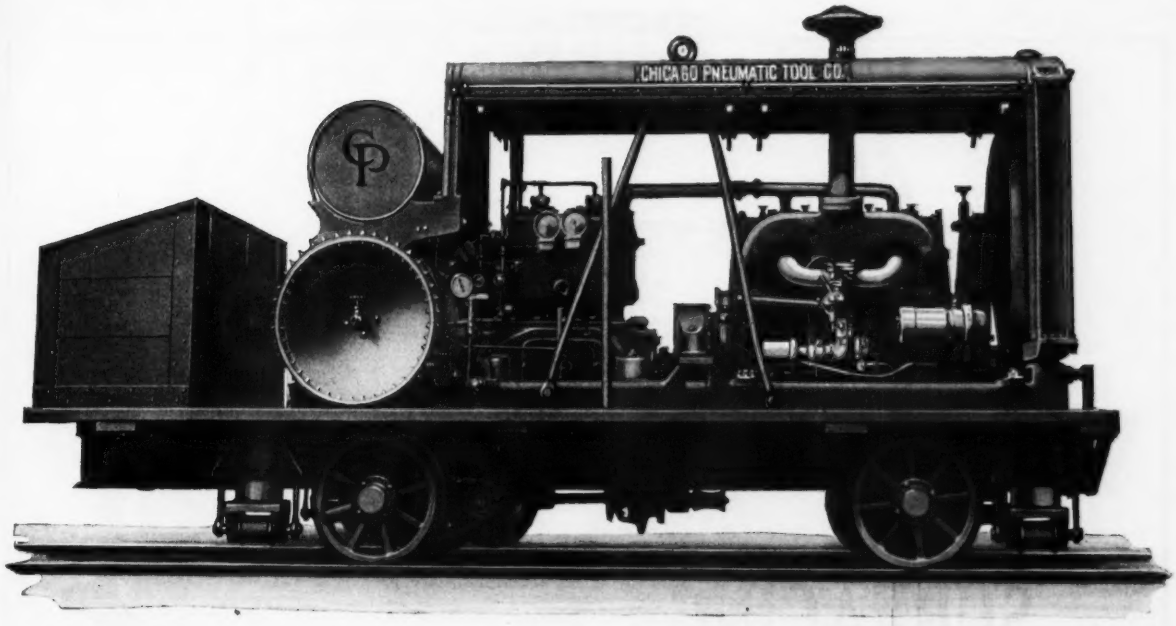

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C-279

CHICAGO · CP · PNEUMATIC

Chicago Pneumatic Tool Co.

Railroad Department

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Illinois Steel Company
General Offices: Chicago

ILLINOIS *Alloy* STEEL

Railway Engineering and Maintenance

Volume 24 April, 1928 Number 4

Spring and the Station Grounds

IN SPITE of the splendid work that has been done by a large number of roads in improving the appearance of their right-of-way and station grounds by the judicious planting of shrubbery, etc., there are still some maintenance officers who plan year after year to do something along this line, but who, for various reasons, continue to procrastinate. Spring, and the season for planting is again at hand, and once more there is an opportunity for these officers to continue to procrastinate. Spring maintenance programs are just getting under way or are about to open on most roads, and this forms a weighty excuse for further delay. This, however, is not the reason why these men continue to put off planting their station grounds, for they know quite well that much can be done with little effort and expense, certainly far too small to have any effect on any sizable spring maintenance program. The main reason is that, while confronted with a multitude of important details themselves, they forget temporarily, and the planting season slips away. Let this note be a reminder that the work of beautifying station grounds already carried out by many roads, may be extended still further during the present year.

Should a Track Spike Be Driven Down?

SINCE the earliest days of track maintenance it has been the constant aim of every efficient roadmaster to keep his track spikes driven down against the base of rail. He has observed that they soon come up, but nevertheless he has insisted that the track men drive them down again. Now, however, a track engineer with long experience as a roadmaster, proposes, in an article appearing on page 156, to abandon this practice and, even more revolutionary, not to drive the spikes down against the rail in the first place, but to leave them about $\frac{3}{16}$ in. high, this measurement corresponding with observations as to the extent to which the spikes rise out of the ties under the undulating wave action of the rails under traffic. It has been suggested still further that spikes be so designed as to prevent their being driven below this point.

At first thought these suggestions are so directly contrary to what have been considered the fundamental principles of good maintenance as to cause consternation. The data presented and the arguments advanced in this article are so pertinent, however, as to entitle these suggestions to careful consideration. It would not be amiss for every division engineer and roadmaster who reads the article cited to duplicate the observations made by the author, for if his results are confirmed and it is demonstrated that spikes left high by a slight amount will remain at that height, the way is pointed to the elimination of a very important cause of tie deterioration, not to mention the saving in labor that will result from the abandonment of the practice of tapping the spikes down.

Welding Structural Steel

FUSION welding has been employed for a number of years for the repair of broken castings, forgings and members made of rolled steel. In the railway maintenance field it has received extended application for building up the battered ends of rails and worn frogs on several roads. Within the last year it was applied in the reinforcement of an important railway bridge and after several years of development work, its use in the fabrication and the erection of steel frame buildings is now emerging from the experimental stage. But, of even greater significance is the recent construction of two railway bridges, one a plate girder span and the other a through truss span in which all field and shop connections were welded.

The assembling of steel plates, shapes and bars into structural members and the connecting of such members for the erecting of bridge and buildings, through the agency of rivets, represents a long established practice. Refinement in design and improvement in shop and field methods have advanced hand in hand and each has been influenced by the requirements of the other. In fact, practices in both the drawing room and the shop have been determined by the limitations and advantages of rivet connections. Therefore, the introduction of a new mode of connection to replace the rivet completely upsets the established standards, and while marked progress has already been made in the development of a technique applicable to welded connections, the structural engineer and the welding engineer must engage in a painstaking co-operative study before fabrication by welding can be placed on a thoroughly established basis.

There is, however, a field in which fusion welding can be made of immediate value and which will be fruitful in the development of service data of definite value in this field—namely, the strengthening of old bridges. Welding will be of particular advantage here because of inherent disadvantages of riveting as applied to such work. Thus, any attempt to increase the section of a stiff bridge member by adding additional plates or shapes has heretofore involved the drilling of new rivet holes or the cutting out of old rivets, both exceedingly expensive processes. On the other hand, it has been demonstrated that new material can be welded to old members successfully and with an appreciable reduction in cost as compared with work attended by the driving of rivets. The correction of inadequate

riveting, for example in the flanges of girders, has imposed another problem which has been solved in some cases by cutting out old rivets, reaming out the holes and driving new rivets of larger diameter. But this is expensive and reduces the net area of the flanges. Bead welding of the flange angles to the webs should offer a more satisfactory and cheaper solution of this difficulty. Other problems of bridge strengthening and repair may be suggested in which welding will offer a simple solution, such as the one described on page 159 of this issue.

New bridges with welded connections will undoubtedly be built in increasing numbers during the next few years while experience is being acquired which will demonstrate just how far the weld will be able to supplant the rivet in this field. In the meantime, railway officers responsible for bridges now in service should carefully investigate the possibilities of welding as a means of extending the life of the structures in their care.

How Strong Is Your Concrete?

ON ANOTHER page of this issue we present an abstract of a set of instructions issued to concrete foremen on the Chicago, Burlington & Quincy for the proportioning of concrete according to the principle of the water-cement ratio. A study of this should convince a reader that this method *can* be made easy to understand and that no difficulty need be experienced in putting it into practical use.

There are those who are reluctant to give up the established practice of proportioning concrete by fixed ratios of cement to fine and coarse aggregates. There is something so simple and so positive about fixed proportions that has a distinct appeal. It leaves nothing for argument between a foreman and his superior officer or between a contractor and an inspector. But is there any virtue in positive proportions, if there is nothing positive about the strength of the concrete mixed according to these fixed proportions? That the use of a 1-2-4 mix does not always produce high strength concrete, or insure the most economical concrete for a given amount of cement per cubic yard of finished structure has been demonstrated repeatedly by railway officers who have applied the water-cement ratio to their work. This is readily shown by an examination of the table of proportions appearing on page 162. It has been commonly assumed that the best proportion of sand to stone for any desired quality of concrete is obtained by using twice as much stone as sand, as indicated by the ratios 1-1½-3, 1-2-4, 1-2½-5 and 1-3-6. But as seen in the section of this table devoted to Oswego sand and gravel (which embraces the limiting sizes of particles ordinarily used), the proportion of coarse aggregate is in no case anywhere near double the proportion of sand.

In taking note of this fact, it is necessary to bear in mind that the proportions given in this table have been shown by test to afford the strongest concrete to be had for a fixed ratio of water to cement, or expressed in another way, in each case the proportions given produce the maximum amount of concrete of a given strength per bag of cement. This means that proportions varying from these will not produce as strong a concrete for a given amount of cement per cubic yard.

This would be of little consequence if the proportions shown comprised only minor deviations from the conventional proportions, but this is not the case, for the differences are so great as to show that, with respect to these particular materials, the use of 1-2-4, 1-3-6 or other fixed proportions will fall far short of giving the best results for the money spent for cement.

It must be remembered, of course, that other materials may give entirely different results and that in other cases the proportions of 1-2-4 may give very nearly the correct proportions for a given water-cement ratio, but it is the very fact that different materials act differently that is the primary justification for the more scientific study of concrete mixes.

The Problem of Superelevation

THE difficulty experienced by the Committee on Track of the American Railway Engineering Association in formulating recommendations for the superelevation of curves, and the recent discussion on this important subject on the floor of the convention serve to emphasize the perplexities in dealing with this question on a road of mixed traffic so that a satisfactory compromise may be reached.

From the conditions governing superelevation, the result must always be a compromise. The mathematics for any given speed over any curve of given radius are well understood and if all trains ran at the same speed the only problem would be one of maintenance—to see that the outer rail was kept the proper height above the inner rail. But all trains do not run at the same speed, and here is where the trouble begins, especially on single track roads with a broken grade line, where the same curve may carry descending passenger trains at the rate of 60 or more miles an hour and ascending "drag" freights moving at a speed of 10 miles an hour. Through station grounds the spread between the maximum and minimum speeds may be even greater, due to some of the trains making the stations stops, while others, to use a time-honored simile, go by "like a pay-car passing a tramp."

The effects on the rail of this difference in speed over curves is well known to all track men: excessive flange wear of the outer rail by trains for which the superelevation is too small and the flattening of the inner rail by the heavy trains for which the elevation is too great. Aside from this there is the danger of derailment of box or other cars with high centers of gravity at speeds considerably below those for which the superelevation was fixed. There have also been cases where derailments of fast trains on curves have been attributed to insufficient superelevation.

From all these reasons the fixing of a satisfactory superelevation is a difficult task and one that requires the exercise of good judgment by all concerned. The roadmaster, supervisor and section foreman can often be of assistance in the solution of the problem, the foreman by observing the behavior of trains passing over the curve and their effect on the rail, while the roadmaster and supervisor are in position to supplement such observations by noting the effect on the "riding" qualities of the trains on which they travel over their territories.

While the section foreman is perhaps the least influential in securing a change in superelevation—and he should never venture to make a change from the prescribed rate except on instructions from his superiors—he is vitally concerned in seeing that the curve is maintained in good line and that the proper superelevation is preserved. Irregularities in either the one or the other are dangerous but when they occur in conjunction they intensify the danger, as well as cause

excessive discomfort to the passengers on the fast trains. Where conditions cannot be remedied by careful and conscientious maintenance of the tracks, those most intimately concerned should not hesitate to ask for speed restrictions.

A Labor Program That Has Worked

FEW ROADS have given more attention to the development of their maintenance of way labor than the Kansas City Southern. For more than ten years, the officers of this road have devoted much time to the development of those measures which gave promise of contributing to increased efficiency. The results of this study, as evidenced by the practices that have been evolved, make the article describing the methods now in vogue on this road, which appears on page 165, of special interest.

The success that has attended the Kansas City Southern's labor methods has come from a well-rounded program, rather than from concentration on any single phase of the subject. This road has given much attention to the recruiting of a proper personnel, and to providing attractive working and living conditions, with the result that a better class of men have been drawn into the service and retained. This objective has been fostered by attention to living conditions, by the maintenance of attractive section headquarters, by the development of satisfactory relations between employer and employee and by the stimulation among the men of a spirit of pride and interest in their work.

With a proper force, attention has then been given to the most efficient utilization of their energies to produce a maximum result. This has been directed primarily towards the elimination of waste effort. First in this direction was an attempt to curtail the turnover of forces, with the resultant inflow of inexperienced men, by reducing fluctuations because of seasonal or other reasons to the minimum. Realizing that much of the unrest and migration among maintenance men individually is the result of the action of the roads in laying forces off when a particular task is completed, a special effort was made to so rearrange the work that it can be carried on by a smaller but more uniform force throughout the year. This has made it possible to offer permanent all-year positions which are more attractive to the men, thereby eliminating the incentive among them to "move on" at the first opportunity with the hope of obtaining permanent work elsewhere.

With a relatively permanent force of experienced men the next problem has been to so direct the activities of these men as to produce the maximum results. This has led to the preparation of definite working programs in which the supervisory officers co-operate with their foremen in planning their work so that it can be done to the best advantage and with the minimum lost motion.

The merits of any system must be reflected in the results produced. On the Kansas City Southern these results are shown in the fact that, in the face of a 20 per cent increase in traffic in 1926 as compared with 1922, the standards of track maintenance were raised with an actual decrease of 4 per cent in man-hours. This result has been achieved almost entirely by greater efficiency in the utilization of labor, for the investment in labor-saving equipment has been relatively small. This road offers an excellent illustration of the possibilities for the reduction of maintenance of way expenditures through the more efficient utilization of the labor already on the payroll and without any appreciable investment for new equipment.

Make Policing Pay for Itself

MORE attention is being given in recent years to the policing and the beautifying of the right-of-way, particularly through station grounds in the residential sections of towns and cities, with a view of creating a favorable impression upon the communities along the line and upon the traveling public. While some roads are sadly remiss in this respect there are other roads which give so much attention to this work, as to give the impression of almost complete disregard of cost. In view of this contrast it is interesting to note the stress that the Committee on Roadway of the American Railway Engineering Association placed on the desirability and importance of policing the entire right-of-way in the report it presented at the recent convention, and the suggestions which it offered to keep the cost of this work to a minimum and to make it pay for itself in so far as this is possible.

Adopting the definition of policing as set forth by the committee—care of the right-of-way, including everything that goes to improve its appearance, add to the safety and convenience of operating the railway, protecting the company's property against fire or other damage, and likewise against the intrusion of persons or live stock and permitting the right-of-way to become a dumping ground for rubbish—it must be obvious that policing is not only desirable but highly essential in many instances. This point is conceded by roads who give little attention to this matter, but which fail to see how the cost involved is justified. As cost, therefore, appears to be the controlling factor, it is well to note the few simple suggestions made by the committee to cut this factor to a minimum: devise some definite method whereby the section forces are required to keep their sections in standard shape as a matter of daily routine; finish each piece of work up to standard as the work progresses, and do not leave it in a partially completed and untidy condition; clean and smooth up the right-of-way so that more extensive use can be made of the mowing machine; collect and salvage all scrap material; collect and pile all loose rock and particularly coarse refuse from the ballast for subsequent use as riprap; and seed the right-of-way with the best grade of hay grass so that farmers will be glad to mow the right-of-way for the hay.

Applying these suggestions will not in itself produce what might be called a beautiful right-of-way at no expense to a road, but it must be evident that it will afford a clean and neat appearing right-of-way, with few hazards to railway property or operation, at a cost so moderate as to make it justifiable.

New Books

Steel Construction—384 pages. 5¼ in. by 8 in., illustrated, bound in flexible leatherette. Published by the American Institute of Steel Construction, Inc., 285 Madison avenue, New York. Price, $1.50.

This is a structural engineer's handbook. In addition to the usual tables of the properties of structural sections, it presents the Code of Standard Practice and the Standard Specifications for Structural Steel for Buildings, adopted by the American Institute of Steel Construction, as well as other specifications employed in the field of structural engineering. Much other information of value to the designer and detailer, not usually found in handbooks, is also included.

What Is a Track Spike For?

Is It to Hold the Rails Down or to Prevent Their Movement Laterally?*

By C. W. BALDRIDGE
Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

UNTIL a few years ago, most people who had to do with railway construction and maintenance were firmly of the opinion that the chief function of the track spike was to hold the rail down. Not only did they believe that the spike should hold the rail down, but most people were convinced that if the spikes could be made to hold the rail tightly in contact with the ties at all times, maintenance troubles would be at an end. This was the reason for advocating the use of screw spikes, bolts which extend entirely through the ties and numerous other fastening devices which attempted to hold the rail and the tie rigidly together.

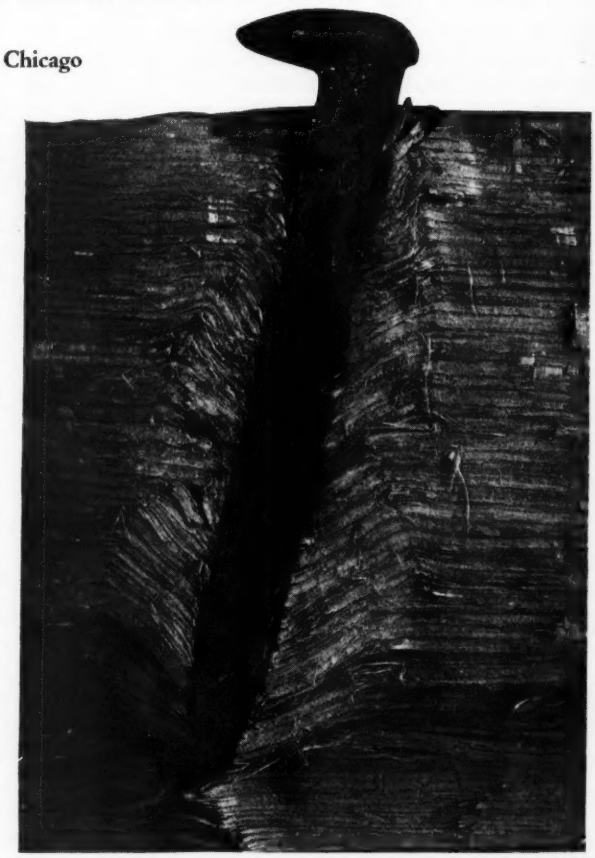
Behavior of Concrete Ties

The fallacy of this idea was shown by a group of concrete ties installed in a railway track at Rivera, Cal., about 1912 or 1913. Two types of rail fastenings were provided in the installation. The ties in the first half of the installation were equipped with a hinged type of fastener which permitted the rails to move up and down freely, but did not permit movement sideways. The ties in the second half of the installation were cast with helical steel linings in holes which provided for the use of screw spikes. This arrangement of unyielding steel threads in the tie, engaging the steel threads of the screw spike, made it possible to attach the rail and the tie rigidly together and to hold them so. The concrete tie has a much smaller coefficient of friction with the ballast than a wooden tie, and owing to this fact the difference in the fastenings was more striking and more readily recognized than it would have been if timber ties had been used.

Only a day or two after this group of ties had been installed the section foreman found that the track was low over the concrete ties, particularly those in which the screw spikes were used, and as time went on he found it necessary to resurface this small group of ties every morning. The adjoining concrete ties with the hinge type of fastenings, while requiring resurfacing much more frequently than the timber ties adjoining, did not require it nearly as often as the rigidly attached, screw spike-fastened concrete ties.

After a study of the conditions by the foreman, the roadmaster and then by the general inspector of track, it was decided to loosen the screw spikes, and they were accordingly slackened about ¼ in., after which the screw spike ties gave no more trouble than the hinge fastened concrete ties adjoining.

This was the beginning of a careful study of the results of the use of screw spikes in comparison with cut spikes in timber ties. One feature of this study took the form of measuring, by the use of a taper gage, the height of the spikes above the base of the rail, that is, the space between the under side of the spike head and the upper side of the base of rail.



How a Spike Bends the Wood Fibers
The spike has its greatest holding power while the fibers are all bent down. Starting the spike bends the ends of the fibers up so that they do not grip the spike so tightly.

After the work of measuring the height of spikes had progressed for a time, it was noticed that in nearly all cases where the spike head was in contact with the base of the rail, the under side of the base of the rail itself was not in contact with the tie plate. In such cases it was evident that the tie was a little lower than the adjoining tie, or ties. While the wheels of passing trains were over the low tie, the rail would spring down enough to put much of the load on that tie, but it would spring up again as soon as the load was off of it, and would be resting upon the higher ties only. Thus is became evident that the spikes had been pulled from the low ties as much, and frequently more, than they had from the higher ties. After the discovery of this condition measurements were made to determine the height of the spikes above the rail, and of the rail above the tie plates. In 1915 and 1916, a considerable amount of work was done in this line upon both screw spikes and cut spikes, the result of which showed that there was practically no difference in the height above the rail of the two kinds of spikes.

Again, during September and October, 1927, a sim-

*Presented before the Maintenance of Way Club of Chicago on February 15.

ilar study was made on cut spikes only. In this study new spikes 5/8 in. square and 6 in. long, which were in use in good sound ties with 110-lb. rails, with 8-in. by 10½-in. tie plates, were measured in four different localities. Four spikes in each of 500 ties were measured for height at each location. Measurements were made of the amounts which the track spikes projected above the base of the rail, and of the space, if any, existing between the base of the rail and the bearing face of the tie plate. The measurements were made by slipping a taper gage between the head of the spike and the top of the rail base, and then by slipping the taper gage between the base of the rail and the top of the tie plate at all four spikes in each tie; the eight readings thus obtained were recorded in proper columns, a line across the notebook being used to make the record for each tie.

A tabulation which shows the percentages of ties on which the rail was in contact with the tie plates and the average height of spikes above the rail follows:

	1925 Rail Illinois Division M.P. 26 Lemont	1927 Rail Illinois Division M.P. 12 McCook	1926 Rail Southern Division M.P. 216—So. of Temple	1927 Rail Southern Division M.P. 21—So. of Temple
Percentage of ties on which the rail was in contact with the tie plates at all four points of measurement	29.44	28.00	17.4	14.6
Average height of spike above the rail in four-point contact ties	9/64 in.	9/64 in.	11/64 in.	8/64 in.
Percentage of ties on which the rail was in contact on both sides of one plate and one side of the other plate	16.67	18.00	52.2	23.0
Average height of spike above rail on three-point contact ties	9/64 in.	9/64 in.	11/64 in.	8/64 in.
Percentage of ties on which each rail had one point contact with each tie plate	4.62	3.40	3.6	13.6
Average height of spike above the rail in two-point contact ties	10/64 in.	8/64 in.	10/64 in.	9/64 in.
Percentage of ties on which rail were not in contact with tie plate at all	20.37	22.40	39.2	18.6
Average height of spikes above the rail in the low ties	7/64 in.	6/64 in.	7/64 in.	9/64 in.
Average height of all spikes above the rail	8/64 in.	8/64 in.	9/64 in.	8/64 in.
Average space between rail and tie plates (all ties)	3/64 in.	3/64 in.	5/64 in.	3/64 in.
Average of total height of spikes	11/64 in.	11/64 in.	14/64 in.	11/64 in.

The figures in the last line of the table show the average amount which the spikes were withdrawn from the ties, plus the settlement of the tie plates into the ties.

The fact that the average height of the spikes in track which had been laid for only three months was exactly the same as with spikes in exactly similar track which had been in use for two years, shows quite clearly that the height of the spikes above the rail is a condition which develops quickly, due to the wave motion in the rail, and one which cannot be prevented. It also goes to show that the real function of the track spike is to hold the rails to gage, and not to hold them down.

Have More Holding Power if Not Started

Experiments made in testing machines which measures the pounds of pull required to draw a spike out of a tie confirm what every track man already knows —that is, that in pulling spikes the greatest amount of force is required at the instant of starting the spike from the wood and that after the spike is once started it pulls much easier than it did in starting. For this reason it is evident that track spikes will have more holding power if they are never started from the tie than they will if driven to contact with the rail, and then started out of the tie by the wave motion of the rail.

At the time of the investigation of the comparative heights of cut spikes and screw spikes a dozen years ago, it was decided that it was best to leave the spike high enough above the base of the rail to permit the wave motion of the rail to take place with out starting the spikes. This was provided for in the case of screw spikes by heightening the boss or shoulder of the tie plate, which made contact with the spike head back of the spike, but nothing has been done until recently toward keeping the head of a cut spike the proper distance above the base of the rail.

Conclusions

Features which should be considered in the selection and use of track spikes are:

1. Since wave motion in the rails cannot be prevented, it should be provided for by leaving the spikes high enough above the rail to allow the wave motion to take place without starting the spikes from the ties.

2. Since the chief function of a track spike is to hold the rails to correct gage, the spikes should have a flat bearing face, as large as is practicable, to make contact against the wood back of the spike.

3. To prevent the wear of the base of the rail into the spike (throat cutting), the bearing face of the spike against the rail should be as wide as practicable. Since a tangent can make contact with a circle at a single point only, any round spike will "throat cut" worse than one which presents a flat face against the base of the rail.

4. To avoid damage to the tie, the spike should be so pointed that it will drive straight; this can best be accomplished by having track spikes pointed from all four sides. To insure the straight driving of spikes and also to enable preservative treatment to enter the wood, spike holes should be bored entirely through the tie before it is treated. Four holes should be bored through the tie for each rail seat, thus insuring a bored hole for each spike whichever way they may be driven. If less than four spikes are used the unused holes will serve to drain the moisture out of the tie plate bed, no matter how deeply it may cut into the tie.

5. To prevent moisture from entering the tie, the spike should be so shaped that it will completely fill the hole made in the wood by it as it is driven. If the spike follows the bored hole in the tie correctly, the bored hole below the end of the spike will help to drain out any moisture which may find its way into the tie alongside the spike.

Building Up Joints at Oakland Pier, Cal., With Outfit Mounted on a Light Tractor

Southern Pacific Uses Electric Arc To Build Up Battered Rails

Both Rubber Tired and Flange-Mounted Equipment Are Employed. 13,000 Joints Welded to Date

IN THE December issue of *Railway Engineering and Maintenance*, page 522, the method employed in building up battered rails by means of the electric arc was described. In that article, which referred to the methods developed by a contracting organization, reference was made also to the fact that the Southern Pacific had purchased and assembled equipment of a similar character for operation by its own forces.

The Southern Pacific, which was one of the pioneers in welding battered rails in track, having begun the practice in 1918 with the oxy-acetylene method, began experimenting with the electric arc in 1923, when a unit consisting of a portable gasoline engine and a generator set was assembled and used for reclaiming manganese frogs, crossings and battered rails in the Los Angeles yards. The work was accomplished by depositing suitable metal from a metallic electrode at the desired place on the rail and then grinding it to a finished surface. The results obtained with this outfit justified further work along the same lines and a second generator set was purchased and mounted on a light tractor so that the machine could be moved on paved streets, thereby avoiding any interference with trains in congested localities.

The performance of these machines led to the assembling of two units for carrying on similar work on the main lines. Each of these outfits consists of a 32-hp. gas engine driving a 200-ampere generator to produce the welding current and a 2½-kw., 250-volt generator to operate the rail grinder. The equipment is mounted on a car with a steel frame, with flanged wheels to fit the track, and with four tranverse wheels for setting the car off the track. These two machines have been in almost continuous use for the past year and their operation has been so successful that three more units were ordered recently for the same class of service. These latter machines are similar in design to the first units, except that they are equipped with 300-ampere continuous duty generators, which have been found to be better adapted to the work than the 200-ampere generators which were used on the first machines.

Each electric welding gang consists of one leader welder in charge of the operations of two units, each of which comprises one welder, one grinder operator and one helper, with a welding machine and a grinding machine. Each generator is equipped with 750 ft. of 4/0 Tyrex cable and 750 ft. of 4/0 uninsulated trolley cable, the former constituting the positive side of the line, with the electrode holder on the end, while the trolley cable is negative and is used as a ground. The trolley cable is not allowed to come in contact with the track rail, being stretched about three feet from it, and consequently causes no interference with the automatic signals. To complete the circuit a short piece of insulated cable is used, one end of which is clamped to the trolley cable near the joint to be built up and the other end to the rail. Each track grinder is equipped with 750 ft. of single two-conductor No. 12 insulated cable. The amount of current used is 225 amperes, with a voltage of 40 at the commutators, which allows for a line drop of about 20 volts.

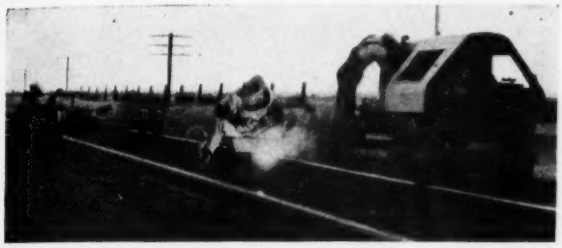
Move Cable with a Motor Car

As the welding of the joints progresses to a point where it becomes necessary to move the trolley cable forward, the end which has been attached to the machine is detached and hooked to a track motor car which hauls it forward 750 ft. The rear end of the cable is then attached to the generator, thus making it possible to work over 1,500 ft. of track without moving the machine.

In building up high carbon structures which have become worn or broken down, a high carbon coated electrode is used for the best results, due to the fact that it does not oxidize as rapidly as the bare rod.

The rods are $\frac{3}{16}$ in. by 14 in. For building up manganese frogs and crossings, coated rods containing 12 to 14 per cent manganese are used. The metal is quenched with cold water after it has been deposited and then ground to a smooth surface.

Two classes of machines are now employed by the Southern Pacific for this service. One is mounted on a light tractor equipped with rubber tired wheels for use around yards and terminals and along paved streets in cities. The other type, for use elsewhere, is



Building Up Battered Rails Near Lordsburg, N. M.
Using electric arc welding equipment mounted on flanged wheels and with grinding machine in the background

mounted on a steel frame and supported on flanged wheels which run on the track. This latter machine is hauled from place to place by an ordinary section motor car and is equipped with four small wheels set at right angles to the flanged wheels by means of which the car can be set off the track on a support at the side and welding operations conducted from this point.

Extent of the Operations

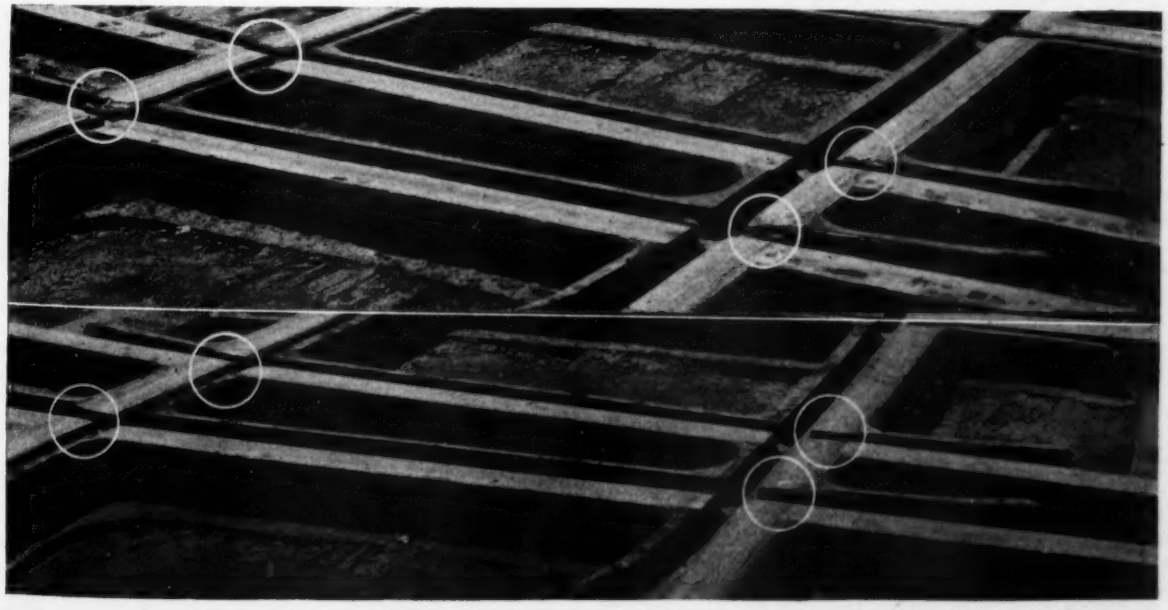
To date the Pacific lines of the Southern Pacific have built up approximately 13,000 joints and about 70 manganese frogs and crossings in the field by electric arc welding. This method is considered satisfactory for the following reasons: The rail is not preheated, since the heat to fuse the metal properly is confined to the arc only; an electric welded joint which has been finished with an electric grinder has a smooth surface and the structure of the parent metal is not upset or disturbed; the electric outfit is a self-contained unit and the only materials necessary to transport to the work, aside from the machines and the auxiliaries, are welding rods and gasoline for the motor.

Repair Bridge Span By Electric Welding

A RECENT application of electric welding in bridge repair work on the Pittsburgh & Lake Erie, illustrates the opportunity for the adaptation of this process to such work. Owing to the wear of pins and pin holes, considerable play had developed in the diagonal web members in the center panel of a 200-ft. pin-connected truss span of the Baltimore type and owing to the absence of any adjustable member in this panel there was no ready means of taking up the slack.

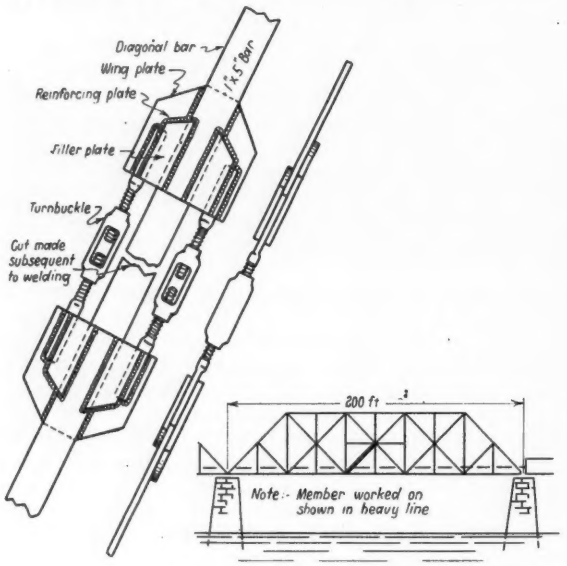
The problem was solved in the manner shown in the drawing, which, briefly, comprised the attaching of a pair of round rods equipped with turnbuckles to one of the lower diagonals, an eye-bar one inch by five inches in section. The rods and turnbuckles, together with the yoke construction for attaching them to the bar, were designed to develop 125 per cent of the full section of the bar. All connections, including both those of the round rods to the yokes and the yokes to the eye-bar, were made by electric welding, as much of the welding as possible being done in the shop to reduce the working time in the field.

As seen in the sketch, the yoke consists of wing plates placed flat against the body of the bar on the far side, together with two filler plates and two reinforcing plates on the near side, the whole being thoroughly secured by bead welding at the edges. After the welding had been completed, and thoroughly tested by hammering, the turnbuckles were drawn sufficiently to take the strain off the portion of the bar between them. Then the eye-bar was burned through, after which the turnbuckles were drawn up again to obtain the desired adjustment of the truss web members.



A Manganese Crossing Before and After Being Built Up With Electric Arc Welding Process

The primary advantage of this form of repair work is that it is carried out with no reduction in the effective section of a tension member such as would take place through the drilling of holes for the attachment of the yokes by means of rivets. It is also less expensive than the replacement of the eye-bars by full-length loop bars provided with turnbuckles



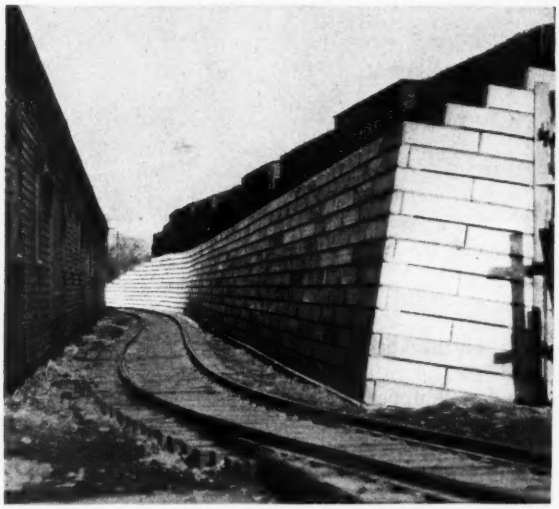
Location of the Member Repaired and the Manner in Which the Work Was Done

while the work can be done in a much shorter time than would be entailed in carrying out the usual form of reinforcement. The manner of introducing these adjustable members was developed by the Pittsburgh Welding Corporation, Pittsburgh, Pa., whose forces also carried out the actual work on the bridge.

Crib Wall Solves Grade Change Problem

IN CARRYING out track elevation work at Scranton, Pa., the Delaware & Hudson was confronted with a problem that is almost invariably imposed on the railroads in grade separation projects, namely, that of continuing to provide side-track service to industries along the right-of-way with a minimum of interference with or change in the industrial facilities. A case of this kind was encountered in connection with a service track to a warehouse and a lumber yard north of the main tracks on the east side of East Market street in Scranton.

In carrying out the separation of grades the main tracks were raised about 14½ ft. above the old grade and to have raised the industry track by the same amount would have required almost a complete rebuilding of the industrial facilities. To avoid this it was decided not to disturb the industry track for that portion of its length opposite the warehouse with respect to either location or grade, and to shift the northerly portion of it away from the main tracks in order to facilitate the development of an incline connection to the main line. This arrangement could be carried out with the use of embankment slopes for a distance of 638

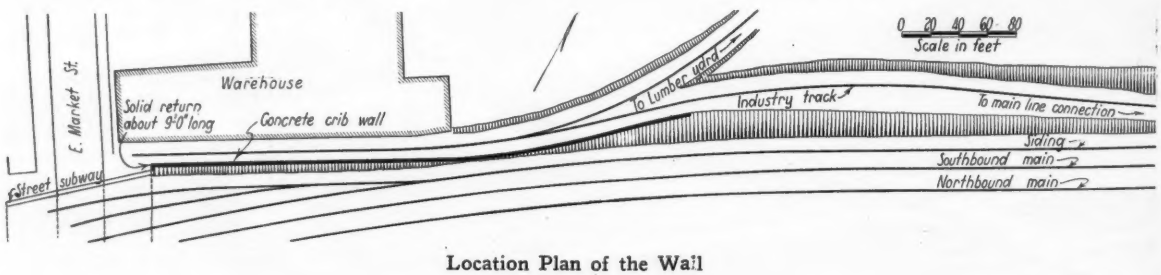


The Wall Just After Completion as Seen from Market Street

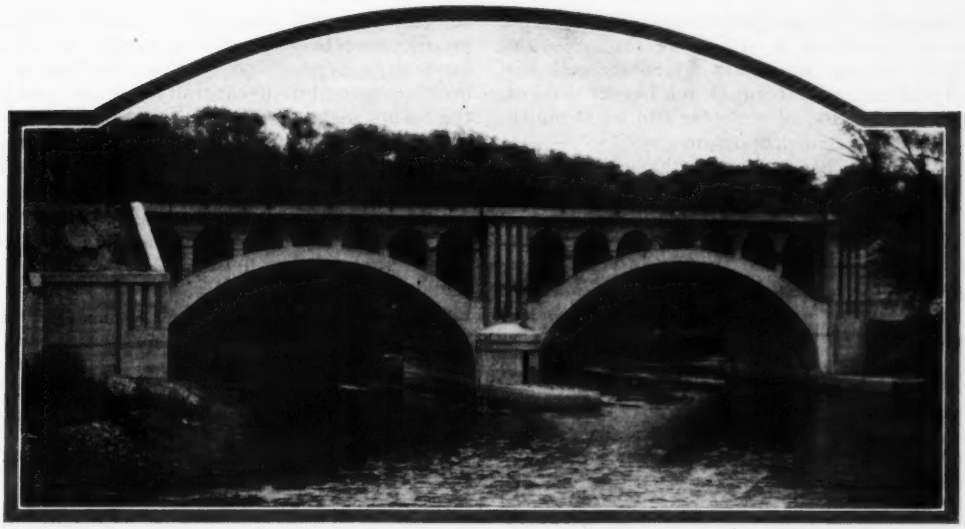
ft. west from the main line connection, but required a retaining wall for a length of 400 ft. east from the street.

The situation was one indicating the advantages of a precast crib type of retaining wall, particularly as it was necessary to build the wall in winter. However, as the wall is visible from the street it was desirable that it have a neat, finished appearance. These and other considerations led to the adoption of the Federal two-piece type of cribbing which, as seen in the photograph, presents a clean-cut face resembling ashlar masonry. The photograph shows also how the wall was returned at the street end to join the abutment for the street subway.

The two units comprising the wall are the face members, set with broken joints and Y-shaped headers or anchors, the headers and stretchers being held together by galvanized dowels which pass through holes in the forward ends of the headers and in lugs at the rear of the face members. These units were shipped to Scranton from the new plant of the Federal Cement Tile Company at Farmingdale, Long Island.



Location Plan of the Wall



Burlington Bridge Over the Fox River at Aurora, Ill.

Explaining the Water-Cement Ratio to Concrete Foremen

Burlington Issues Table of Aggregate Proportions But Forbids Changes in Amount of Water

ADVOCATES of the water-cement ratio as the criterion for proportioning concrete have frequently been confronted with the argument that its accurate application is not practicable in cases where the work is not under the control of someone who can carry out the mathematical calculations necessary. Others object to the cut-and-try methods under which the foreman develops the most suitable proportions of fine and coarse aggregates for a fixed ratio of water to cement by making trial mixes. The Chicago, Burlington & Quincy has overcome both of these objections in instructions for proportioning concrete which have been issued to the foremen.

Make Study of Aggregates Used

Using the aggregates in common use on that railroad, careful screen analyses and test mixes with given ratios of water to cement have been the means of determining proportions of fine and coarse or of mixed aggregates which will give workable mixes for each of the selected ratios of water to cement. This information was then used for the development of a table of proportions for concretes of various desired strengths at the age of 28 days, this table giving the proportion of water as well as those of the fine and coarse aggregates, that for water being expressed in gallons per bag of cement.

As it is recognized that aggregates from any source are subject to variations which will affect the workability of concrete mixed to fixed proportions of both aggregate and water, these instructions provide that the amount of water may be increased, if necessary, but that a proportionate increase *must be made* in the amount of cement. In other words it is made plain to the foreman that the one item in the table of proportions for any given class of concrete which *must not be changed* under any circumstances is the number of gallons of water per bag of cement.

That part of the instructions relating to the proportioning of concrete is reproduced below. As a note of caution, attention is directed to the fact that the table of proportions is applicable only to the particular materials mentioned. It does not follow that the same proportions will apply to aggregates taken from other pits, even if the limiting sizes of fine and coarse aggregates should be the same. The grading of the particles, between the upper and lower limits, the fineness modulus in other words, as well as other characteristics, exert a pronounced effect in determining the most workable mix for any water-cement ratio.

These proportions may be used, of course, as the starting point in making trial mixes, using the slump test as a check of their workability and remembering that the object is to get a mix which will contain the largest possible amount of sand and stone without increasing the amount of water per bag of cement or without sacrifice of the proper workability.

Abstract of the Instructions

Water, when mixed with cement in the right proportion, forms a paste-like substance that binds the sand and stone or pebbles together into one solid mass. When too much water is used the glue-action is lost to a great extent. Only sufficient water shall be used to cause this paste to spread over the surfaces of the various grains of sand, pebbles or stone, and act as a lubricant between the sand and gravel, helping to place these irregular particles in the forms.

Only 2½ gal. of water are required to slake one bag

of cement properly. To produce a workable concrete it is necessary, however, to use more than 2½ gal. of water for each bag of cement. Generally it will take from 4 to 6 gal. of water for each bag of cement, depending upon the kind of concrete and its strength, as shown in the table of proportions.

The foreman must bear in mind that the strength of the concrete depends greatly on the amount of water used with each bag of cement. If he should find that the specified amount of water does not produce a workable mixture, it may be permissible to add some water and a proportionate amount of cement, thus keeping the amount of water per bag of cement the same as specified for the particular concrete. *Under no circumstances shall water be added to produce a workable concrete without adding a proportionate amount of cement.* The foreman must always remember that each extra pint of water wastes about two pounds of cement, as far as the resulting strength of the concrete is concerned.

The extra water used above the amount required for slaking the cement takes up a certain amount of space in the concrete. When the concrete has fully set, this water will eventually evaporate, leaving hollow spaces or voids in the concrete and reducing its strength and resistance to weathering. A well mixed concrete with only the proper amount of water in it may appear too stiff to produce a smoothly finished face; but if carefully worked and spaded in the forms such concrete will do away with sandy and moldy surfaces which are the result with all sloppy concrete mixtures. Too much water tends to separate the sand and mortar from the larger pebbles, making it hard to handle and thus defeating the purpose for which it was introduced.

The next column shows one method for controlling the amount of mixing water. Every foreman is hereby instructed to rig up some such device for measuring the mixing water, if the mixer is not similarly equipped already, and see to it that the amount of water used corresponds with the amount specified in the table of proportions, or as given on the plans for the particular job.

Proportions

The proportions of water and cement to pit run gravel, or to sand and pebbles or stone, shall be in accordance with the table of proportions for the various classes of concrete as shown on plans. All

TABLE OF PROPORTIONS

Grade of Concrete	Minimum strength desired 28 days	Slump desired in inches	Field Proportions				Net Quantities For cubic yard of concrete			Kind of Sand and Gravel
			Cement bag	Sand cu. ft.	Pebbles cu. ft.	Water gal.	Cement bags	Sand cu. yd.	Pebbles cu. yd.	
A	1500	3—4	1	4.00	4.25	6.43	4.36	0.65	0.69	
B	2000	3—4	1	3.30	3.60	5.66	5.09	0.62	0.68	Oswego, Ill. Sand 0—¼ in.
C	2500	3—4	1	2.50	3.00	5.06	6.12	0.57	0.68	
D	3000	3—4	1	2.00	2.50	4.60	7.18	0.53	0.66	Oswego, Ill. Pebbles ¼ in.—1¼ in.
E	1500	6—7	1	3.33	3.50	6.64	5.02	0.62	0.65	
F	2000	6—7	1	2.75	3.25	5.81	5.62	0.57	0.68	
G	2500	6—7	1	2.12	2.80	5.15	6.60	0.52	0.68	
H	3000	6—7	1	1.62	2.32	4.70	7.83	0.47	0.67	
A	1500	3—4	1	4.10	1.90	6.47	5.70	0.87	0.40	
B	2000	3—4	1	3.34	1.90	5.66	6.40	0.79	0.45	Oswego, Ill. Sand 0—¼ in.
C	2500	3—4	1	2.75	1.75	4.98	7.28	0.74	0.47	
D	3000	3—4	1	2.25	1.75	4.48	8.00	0.66	0.52	Conkey Pea Gravel ¼ in.—⅜ in.
E	1500	6—7	1	3.50	1.75	6.62	6.22	0.81	0.40	
F	2000	6—7	1	3.00	1.80	5.74	6.78	0.75	0.45	
G	2500	6—7	1	2.37	1.86	5.04	7.54	0.66	0.52	
H	3000	6—7	1	2.00	1.50	4.58	8.72	0.65	0.48	
			Pit Run Gravel, cu. ft.				Pit Run Gravel, cu. yd.			
A	1500	3—4	1	4.70		5.15	6.25	1.09		
B	2000	3—4	1	4.45		4.30	6.75	1.11		
C	2500	3—4	1	3.73		3.95	7.90	1.09		
D	3000	3—4	1	3.35		3.50	8.25	1.02		Platte River pit run gravel
E	1500	6—7	1	4.00		5.10	7.50	1.06		
F	2000	6—7	1	3.75		4.50	7.75	1.07		
G	2500	6—7	1	3.50		4.00	8.25	1.07		
H	3000	6—7	1	3.25		3.55	8.50	1.02		
A	1500	3—4	1	5.50		4.50	5.70	1.16		
B	2000	3—4	1	4.40		4.10	7.00	1.14		
C	2500	3—4	1	3.90		3.60	7.75	1.12		
D	3000	3—4	1	3.50		3.10	8.25	1.06		Guernsey pit run gravel
E	1500	6—7	1	4.50		4.70	7.00	1.16		
F	2000	6—7	1	3.40		4.40	8.50	1.07		
G	2500									
H	3000									

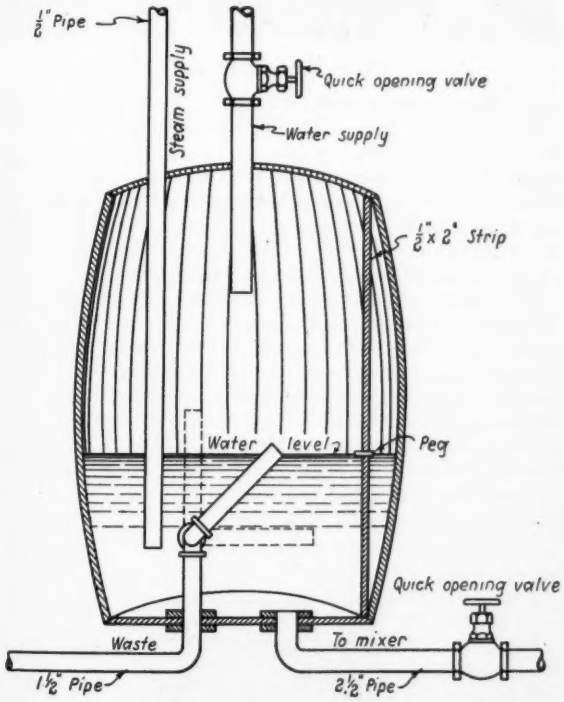
NOTES

1. Grade "A" concrete for mass concrete not exposed to weathering processes.
2. Grade "B" concrete for piers, walls, box culverts and for mass concrete exposed to weathering processes.
3. Grade "C" concrete for slabs, beams, girders and columns.
4. Grade "D" concrete for slabs, columns and other structures for which a stronger concrete than grades A, B and C, is desirable.
5. Grades E, F, G and H, are similar to A, B, C and D, respectively, and are to be used on structures highly reinforced or of small cross section, where greater workability is desirable than that obtainable from a concrete slumping 3 in. to 4 in.
6. Grades F and G, using Conkey pea gravel, or Platte River gravel, is designed expressly for concrete piles, pipe and posts, and for steel encasement.
7. The figures in the table under the headings "Field Proportions" and "Net Quantities" are based on loose measures and a moisture content of about two per cent in the Oswego gravel, three per cent in the Conkey pea gravel, four per cent in the Oswego sand, Platte River and Guernsey gravel.
8. Quantities as tabulated above are net; no allowance for waste is included in this table.

materials shall be accurately measured, preferably by means of a box containing one cubic foot. A box measuring one foot in all three directions shall be carried for this purpose on all concrete jobs. This box may be used to gage the wheelbarrows or the loading hopper. The foreman shall see that similar loading is strictly observed by the men. Strike-off boards are of much value in maintaining constant and accurate proportions. They may be shaped so as to load the wheelbarrows to any desired degree of fullness.

When the mixer is provided with a charging hopper, it will be advisable to place a partition in it, thus securing separate compartments for the sand and stone. These compartments shall then be gaged with the cubic foot measuring box, and similar loading observed throughout the progress of the job. Under no circumstances should guess work be employed in measuring any of the concrete materials. A special measuring hopper may easily be built where there is no other way of measuring the materials.

When sand is mixed with a small percentage of water, its volume will increase, while its weight per cubic foot will decrease considerably. This increase



Barrel for Controlling the Amount of Mixing Water

of volume, or bulking of sand, due to moisture increases with the fineness of the sand, and must be taken into account when the materials for making concrete are measured. Three to four per cent of water in ordinary concrete sand will increase its volume 15 to 25 per cent. The volume of stone and screened gravel is affected very little by an ordinary amount of moisture. The table of proportion of these instructions is based on a moisture content of about four per cent in the sand and two per cent in the stone. When the sand is drier its weight per cubic foot will be greater and it will take somewhat less sand than shown in the table. When the sand and gravel are drier than assumed for this table a little more water will be required than shown on the table for damp materials. The amount of water used shall be carefully looked after as the strength of the concrete depends greatly on the specified quantity of water per bag of cement. It is practically impossible

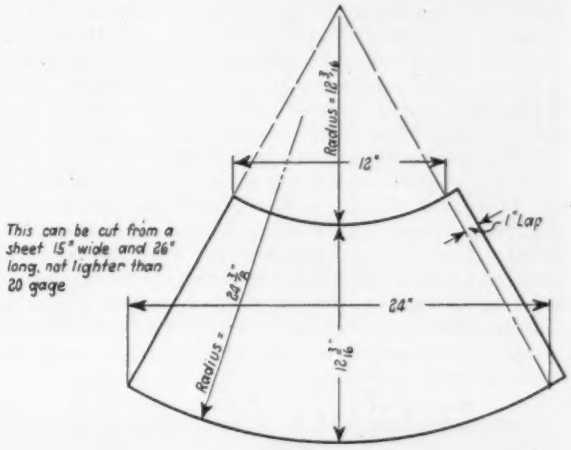


Diagram for Cutting the Sheet Metal for a Slump Test Cone

to make a good job with a concrete that is too dry, but it is very easy to spoil the concrete with too much water.

The Slump Test

The total amount of water, including that contained in the sand and gravel, to produce a certain workability or consistency, is known. The amount of water in the sand and gravel, however, may vary considerably from day to day, depending on the temperature, an occasional rain and the size of the stock pile. As it would be hard for the foreman to determine the amount of water in the sand and gravel often enough to enable him to regulate the amount

Filling the Cone for a Slump Test

of water to be used at the mixer, the slump test may be used as a check on the workability or consistency of the concrete. This test will serve indirectly as a check on the amount of water used. It is very simple and may be easily made by the foreman.

All that is required for this test is a cone-shaped form made of sheet metal and a ⅝-in. by 18-in. rod, pointed at one end. The slump cone has a diameter of 8 in. at the bottom, 4 in. at the top and is 12 in. high. This cone-shaped form is placed on a level surface and filled with an average sample of the concrete to be tested in three layers of about four inches each, and each layer is rodded 30 times with the ⅝-in. rod; the top is then leveled off; the surplus concrete outside the form removed, and the form lifted off vertically. The amount that the concrete settles is called the slump and may be easily measured as shown in the picture. Concrete giving a slump of three to four inches is desirable for ordinary reinforced concrete construction. Drier concretes may be used in footings and in other massive structures. The table below giving the strengths of concrete for various slumps may serve to impress the importance of using as little water as possible.

Removing the Cone

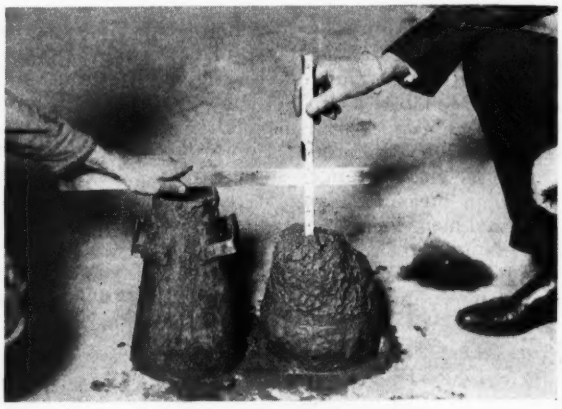
Slump of Concrete	Strength of Concrete
½ in. to 1 in.	3250 lb. per sq. in.
3 in. to 4 in.	2850 " " " "
6 in. to 7 in.	2200 " " " "
8 in. to 10 in.	1500 " " " "

The extra wet concrete is only about half as strong as the extra dry concrete, the amount of cement used being the same in all cases.

Mixing Concrete

All concrete shall preferably be machine mixed wherever possible. It will generally take 1½ to 2 min. of actual mixing after all the materials have been placed in the mixer to secure good results. The mixing of all materials including the water may be done in one operation.

When the amount of concrete to be placed is very small, or when it is necessary to finish a day's run and the mixer is out of order, mixing by hand will be permitted. When mixing concrete by hand, the dry materials shall be mixed until a uniform color is secured, the water shall then be added gradually and mixed with the materials, taking care to avoid the loss of cement mortar. The mixing shall continue until the concrete is plastic, or "fat" as the masons call it. When the concrete is in this condition it is at its best and can be placed in the forms without separating the stones from the mortar. The proper amount of water and other materials, as given in the table, shall be carefully measured out. *To use more water in order to make the mixing and placing of the concrete easier is strictly forbidden.*



Measuring the Slump

The foreman must bear in mind that insufficient or improper mixing will always result in a poor concrete. Concrete that has not been mixed thoroughly shrinks more than a well mixed concrete; it also shrinks very unevenly, probably because it is not uniform, some parts being richer in cement than others. The defects resulting from this often do not appear for several years after the work is finished, so that the men responsible for the poor workmanship often do not know the results of their negligence.

Southern Pacific Bridge Over the Gila River in Arizona

This Track Was Maintained with a Uniform Force of a Foreman and Three Men

A Program That Has Worked

The Distribution of Work on the Kansas City Southern Throughout the Year Has Improved Performance

By H. B. VESS

Editor, Employees' Bulletins, Kansas City Southern, Kansas City, Mo.

IF ONE of an older generation of track men had been told that it was practicable to maintain the physical property of a railroad (meaning principally the track and roadbed) on the basis of a systematic program, and to do it better, with fewer men and at less cost, he would have scoffed at the statement. To his mind it was impractical and impossible to map out a definite program of work for the track gangs on a railroad for a year, a season, a month, or even a day ahead, because, he would say, there are so many different jobs to do and so many unexpected and unforeseen things come up to spoil the best laid plans.

That idea was common 20 years ago. Even 10 years ago it was only on a few railroads that any different plan was followed. A committee reporting to the annual convention of the Roadmasters' Association in 1916, on the seasonal distribution of maintenance work and forces, reported against such a program, stating that "the Committee is not in favor of standard maintenance forces the year round; it is necessary to take care of the heavy section work in from five to eight months," adding that the distribution of section work the year round was impracticable. Although the Association amended the report and voted in favor of working toward the system of uniform maintenance forces the year round, adopting it entirely where feasible, there was much sentiment against it.

Ever since there have been railroads there has been a "maintenance problem": the problem of maintaining the track, roadbed, and bridges—the running part of the railroad—in safe and satisfactory condition for operation, at a cost which did not represent too great a proportion of the earnings of the railroad. In the years of prosperity and good earnings the problem did not cause so much concern, but in the lean years it often became acute.

It has not been so many years since it was standard practice, and considered good practice, to reduce the track forces at the first suggestion of frost in the air. The first chill of early fall would find the superintendent requesting of his roadmasters an estimate of their minimum labor requirements for the next six months. And the roadmasters would prepare their estimates of the minimum number of men they could possibly get through the winter with —the more experienced perhaps swelling the "minimum" in anticipation of what they knew was to come —and get back their estimates cut in half, or worse. It was in the maintenance department that the axe fell first when the earnings dropped.

And it may have been that all this was necessary and proper. Good business decreed that expenditures should follow earnings. Labor was plentiful, or fairly so, although its character was changing. Native labor was becoming increasingly harder to get and retain; it was passing up the railroad as a means of livelihood, and its place was being taken by labor from the countries of southern Europe, and on some railroads, by laborers from south of the Rio Grande. This labor was cheap, probably not as efficient, but the margin between income and outgo was wider than it now is, and the need for more efficient and economical performance was not so apparent.

Then, too, the belief that the greater part of the maintenance work must be done in the warmer months of the year was general. There were doubtless many conditions which made it seem advisable to employ a great many men for track work in the spring, crowd the year's work into six or seven months, and then to dismiss most of these men in the fall, retaining only the foreman and a man or two—and sometimes only the foreman—on each section to take care of such conditions as required attention during the winter.

It is probable that there were, and still are, rail-

roads on which such a practice is necessary. Railroads which run through a part of the country where climatic conditions are severe and the winters extremely cold, no doubt felt, and still feel, that work done during those months when the temperature hovers around the zero mark will not be as economical or as well done as when the weather is warmer and men can work and move more freely. But for the bulk of the railroad mileage of the United States these conditions do not prevail; on most railroads the programming of maintenance work and the working of a uniform force throughout the year are practicable, and on some railroads are being done.

Requires Experienced Men

The essential thing, however, is that the earlier viewpoint has changed, and changed greatly, in the last 12 or 15 years, and that maintenance work is coming more and more to be regarded as worthy of study and attention by the "best minds" in the railway engineering profession. Track laborers have passed from the "unskilled" to the "skilled" class, and the track foreman has risen from a "king snipe" to a supervisor of men considered to be skilled in their work.

Several influences have contributed to this change in sentiment. The work of the efficiency engineers has perhaps had its effect. The increasing scarcity of labor, and its higher cost, have been very potent influences. Probably it was the steadily mounting cost of maintenance work, which tended to increase the maintenance ratio above what was considered proper, that focused attention on the problem, and brought about the more thorough and intensive study of track maintenance work.

Out of this more intensive and scientific study of railroad maintenance have come different schemes for increasing the efficiency of the maintenance forces. Some of these schemes have been elaborate, others simple, probably all have had their virtues, and probably all have represented progress. As a beginning, all of these schemes advocated the following of a definite and systematic program of work; some content with merely arranging the work and assigning certain tasks to certain periods of the year; others went far beyond, into the intricacies of records and standards and schedules for putting in ties, laying rail, ballasting, cutting right of way, and the many other items of work that a maintenance man is called upon to handle.

The Kansas City Southern was one of the railroads which became interested in these plans for increasing the efficiency of the maintenance forces. But while recognizing the value of the new ideas, it wished to test them by experience, and to keep its feet on solid ground. Its earnings would not permit too great an excursion into the realms of experiment, yet it wished to avail itself of the advantages and economies which lay in the more efficient ways of handling maintenance work.

The experience of the Kansas City Southern, and the studies it had made, convinced its officers that there was much work commonly done in the summer months which could be done satisfactorily at different periods of the year. Rail could be laid on any part of its line in the fall and winter as well as in summer; other classes of work which had been done during the warm months could be done as well in the colder period of the year. This would leave for the spring and summer the work which involved disturbing the roadbed and was best done after the frost had left the ground, and before the rainy season began in the fall.

This road felt, too, that there was much benefit to be had from the building up of an organization of experienced men, which would be a natural result of the employment of a uniform force throughout the year. The prospect of regular employment, it was believed, would attract to its service men of a better class than could be secured under the uncertain conditions which formerly existed. Also, men assured of steady employment would be more cheerful and contented, do better work, and be more willing to remain permanently in the service, and with experience become more valuable members of the organization.

In laying its plans, this railroad did not experiment with the making of time studies and the formulating of schedules. It simply worked out a uniform force, guided by the funds available for labor under its usual allowances, mapped out a seasonal program based upon its experience and its convictions of what could be done, and went ahead.

A Maintenance of Way Association

There was one thing the Kansas City Southern believed in and that it considered essential to the success of its plans; it believed in taking its men into its confidence, talking its plans over with them and working them out together. It believed that men respond to confidence reposed in them, and that they will take a greater interest in carrying out plans which they have a hand in formulating.

Therefore, before setting out with a seasonal program of work, the railroad carried out a long-cherished dream of some of its maintenance officers, and organized within its ranks a maintenance of way association. Its membership included those in the maintenance department of and above the rank of foreman. In form this association was modeled after the national railway associations, such as the American Railway Engineering Association and the Roadmasters and Maintenance of Way Association, with one important exception: the officers, consisting of a chairman, a secretary, and an executive committee hold their offices in the association by virtue of their positions with the company, except the secretary, who was appointed. Thus was eliminated politics, the rock on which so many organizations meet disaster.

The purpose of the Kansas City Southern Mantenance of Way Association is the study of maintenance problems, and the promotion of co-operation and good fellowship. Meetings are held monthly, on alternate divisions, and the maintenance work of the railroad, from putting in ties and laying rail to making reports and improving the station and section grounds, has been thoroughly discussed, a regular program of papers and discussion being followed at each meeting. It is sufficient to say here that experience has fully demonstrated the value of these meetings and discussions, which are still being held, and the maintenance officers would not willingly forego them.

After the association had been in operation perhaps a year, and the ground had been covered in a general way, the management put into effect the seasonal program of work, and its complement, the uniform force. The uniform force, as first established, consisted of a foreman and three men on outlying or line sections, with appropriately larger forces

in yards and on more difficult sections. In the nearly five years that have elapsed it has rarely been found necessary to vary from the average force set up in the beginning to handle the regular section work.

The Year's Work Was Programmed

The seasonal program, as first announced, started with the tie renewals, beginning as near the first of the year as weather conditions permitted. Four days a week were to be devoted to putting in ties, allowing two days to look after soft spots and other general work of the section. Tie renewals were to be completed by July 1. Along with the tie renewals and before the hot weather started in the late spring, the forces were to tighten up any loose bolts that might have developed during the extreme cold weather. The next six weeks were to be spent in ditching the wet cuts and spotting up the track. Right of way cutting was to begin on August 15, to be followed by the remainder of the ditching, the dirt taken from the ditches being used where practicable in building up the embankments. With this work out of the way, bolts were tightened and oiled over the entire railroad. Then came the cleaning of the ballast section, removing the vegetation and dressing up the ballast shoulder and toe line. This work was to be completed by the last of November. During this period the annual inspection of ties was made, roadmasters and foremen going over the sections and spotting with white paint the ties which, in their joint judgment, should come out the next spring. The three months from December 1 to March 1 were to be spent in cleaning up the right of way, removing brush, stumps, etc., unloading and piling ties, installing rock drains, smoothing up the track, tightening bolts and oiling joints, and taking care of odds and ends of work to allow a "clear track ahead" when the time came for putting in ties.

This original plan has been and is being changed and modified from time to time, as experience shows advisable. Tie renewals, for example, are being completed before July 1 on many sections. The time required for some of the other operations has been shortened as the track forces gain experience and become more skillful, and as conditions become better. This is permitting the inclusion in the program of other items of work heretofore deemed less important, and is allowing the spending of more time in applying the "finish" and providing smoother riding track and better appearing right of way and station grounds.

The Results Are Evident

Now, what have been the results of this plan of a uniform force and a seasonal program of work? First, let us look at the figures. Figures are not always conclusive, and many conditions affect them. Over a period of several years, however, they do show the general trend. During the years this plan has been in effect, there has been a rather steady increase in the volume of traffic. In 1926 the traffic, based on gross ton miles, was 20 per cent heavier than in 1922, yet 4 per cent fewer man-hours were worked by road department forces in 1926 than in 1922. The ratio of maintenance expenditures to gross earnings has been appreciably reduced since the track forces have been put on a uniform basis, and a seasonal program of work followed.

But while the decrease in the money cost of the maintenance of the railroad, as shown by the accounting department figures, is interesting, it doesn't tell the whole story. The statistical records cannot portray the improvement in the physical appearance of the road, the better riding condition of the track, or the greater snap and efficiency in the whole organization as a result of the systematic planning and carrying out of the work. It has been found possible to accomplish with a small uniform force and a comprehensive seasonal program of work, many things which could not have been done under the older order of things without a much larger force, and at much greater expense.

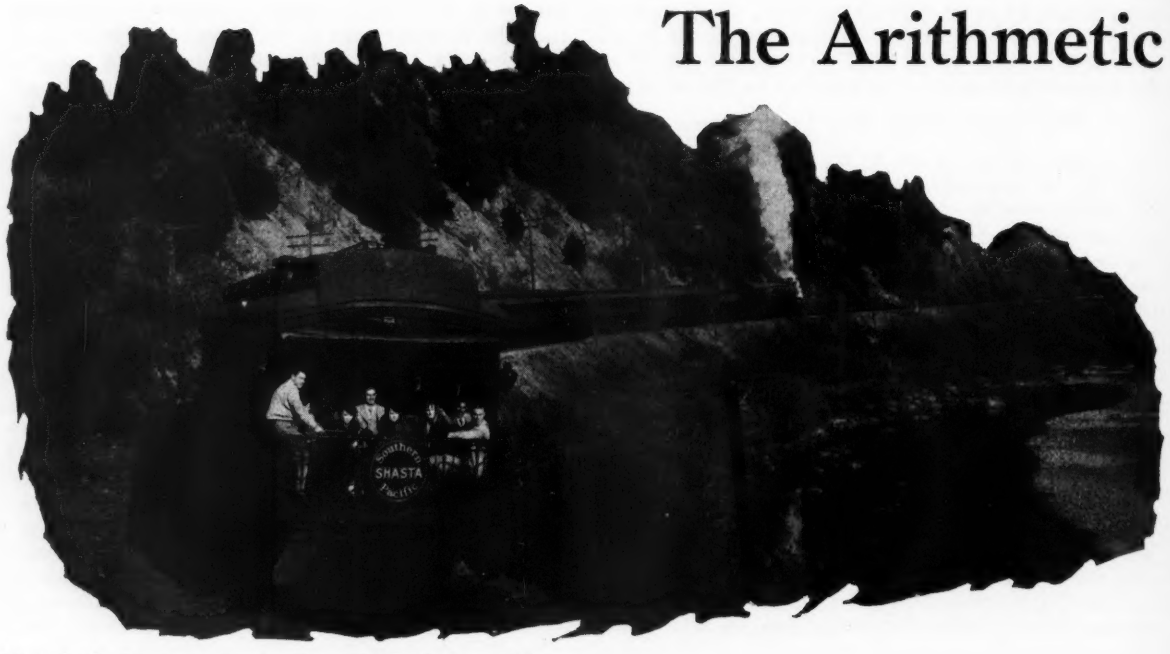
The improvement in the appearance of the railroad has consisted of a cleaner ballast section, with a uniform shoulder and usually a toe line, a cleaner right of way, a better upkeep of the facilities around the stations, and greater attention to parks and similar efforts at stations. The better riding condition has been the result of the systematic and consequently more thorough carrying out of the work. But it is upon the organization itself that the effect has been best, and it has been only because of it that the two results first mentioned have been possible.

The first effect of a uniform force was, naturally, a lower labor turnover. This in itself was productive of efficiency, for the reason that men were kept steadily employed who had acquired some degree of skill in track work. As is well known, the loss of experienced men in the fall and the breaking in of new men each spring, with the large labor turnover throughout the summer or working season induced by the temporary character of the employment, has been fatal to the attainment of the highest degree of efficiency.

A recent report of a committee of the Roadmasters Association quoted the U. S. Department of Labor as having found that output increases steadily with length of service, and that two-thirds of the work is done by employees who have been in service 10 to 20 years. Poor quality and low production have been found among workers with short terms of service. That this has been generally true in railroad maintenance work will be agreed. The effect of the uniform force has been to increase the production per man-hour, with no lowering of the quality of the work; in fact, the work has generally been done better, and is of a more lasting or permanent nature.

But perhaps the most important result has been the effect upon the minds of the foreman and his men of a program, that "method of operation or line of procedure prepared or announced beforehand," —as the compilers of the Century Dictionary define the word. It has been the experience of the Kansas City Southern that with the seasonal program of work carefully prepared and with due allowance for the various conditions liable to come up, the mind of the foreman is clarified and set at rest. He has a definite plan to follow; he knows exactly what he is going to do. He is able to concentrate his mind and his energy on the doing of the work in hand, with the feeling that if this work is done properly, he will be free to turn to the next class of work on the program, and concentrate similarly on that. He knows his program, has perhaps had a hand in its making, has discussed it with his fellow foremen, his roadmaster, and the higher maintenance officers, and knows that it is arranged to take care of each particular class of work at the time best suited for it. So he works with the knowledge that if he follows the program, his section will be well maintained, and that to the extent that he falls down on his job his section will suffer by comparison.

The Arithmetic



High Grade Passenger Service Demands Good Curve Alinement

IN THE TWO previous articles of this series the manner of taking the measurements of an actual curve has been presented. In this article it is assumed that it has been decided to change the actual curve in certain ways so as to rectify any errors of curvature that may exist, such as sharp and flat spots. This article will set forth the fundamental principles underlying the means of effecting the change from the actual curve to the revised one. In the following discussion, no mathematical analysis is given for any of the principles stated, except the simple geometrical proof for the theorem regarding the throwing of a joint or station, although complete and satisfactory proof can be given mathematically for all of the rules given. These proofs are omitted from this series of articles as it is thought that they will not be desired by most of the readers.

Sum of Ordinates Must Remain Constant

The first principle of string-lining is that the sum of the ordinates of a curve must remain constant throughout any series of operations designed to correct the alinement of that curve. In other words, if a curve is measured and the ordinates taken in the field total 656 tenths (or eighths, quarters or any other units) of an inch, the total 656 must remain the same for any revised curve. It can be proved that this total represents the actual angle between the two tangents or pieces of straight track at each end of the curve; and inasmuch as it is obvious that the angle between the straight tracks cannot be changed, the total of the measured ordinates must not be changed.

The second principle is that the sum of the errors between the figures for the original curve and the figures for the revised curve must equal zero, the error at any station being defined as the difference between the original ordinate and any revised ordinate selected by the man lining the curve. It is, briefly, the original ordinate less the revised. Suppose that at some station of a curve the ordinate measured in the field is 48 eighths of an inch, or 6 in. If, for reasons explained later, it is desired to change this ordinate when re-lining the curve, to some such figure as 41 eighths of an inch (or 5⅛ in.) the *error* at that station will be 48 less 41 or 7 eighths of an inch. If the revised ordinate is larger than the original, the difference or error is termed negative and a minus sign placed in front of it. For example, if the revised ordinate in the above case happened to be 53 instead of 41, the error would be 48 less 53 or minus 5 eighths of an inch. In view of the above explanation, it will be clear to the reader that, if the total of the revised ordinates must equal the total of the original ordinates, the total difference between the two must be zero, the total difference being merely the sum of the separate differences or errors at each station. In other words, the second principle is practically the same as the first, but is merely a more convenient way of expressing it.

Effect of Throw on Adjacent Stations

The third principle is very important, and should be thoroughly understood before the reader attempts to line any curve. It is as follows:

Rule: If one joint (or station) of a curve is moved in or out a certain distance (which distance is called the throw), the middle ordinates at the stations on each side of the one moved will be changed by half the amount of the throw, and in the direction opposite to the throw.

The above rule is best explained by a diagram. Let the reader refer to the accompanying figure, in which is shown a portion of a circular curve ABC, whose chord is AC and middle ordinate MB. The arc ABC can be taken, if desired, as the length of two rails of the high side of a curve, with AB as one rail and BC as the other, with the joint at B. It is plain, therefore, that as a practical matter, the rail BC can be moved

*This is the third of a series of six articles on the string lining of curves, describing the manner in which the line can be corrected by the track men without the use of instruments other than a piece of string and an ordinary rule. The first article of this series, which appeared in the January issue, page 4, presented the merits of this practice in contrast with the use of a transit. The second article, which was published in the February issue, page 62, describes the methods of taking the measurements. The fourth and fifth articles, which will appear in the May and June issues, respectively, will describe the method of selecting the ordinates for the revised curve and the sixth and concluding article will describe the manner of placing the stakes preliminary to the lining of the curve.

# of String Lining Curves*†

A Statement of the Principles on Which This System Depends for Its Accuracy

By CHARLES H. BARTLETT

without disturbing the rail AB. Therefore, consider that the joint (or station) C is moved or thrown out—that is, away from the center of the curve—to the point D, so that the rail BC now occupies the position BD. The new chord (or line representing the position of the string) is now the line AD, and the new middle ordinate is BE. In actual practice, the length BE is so closely equal to MB (the original middle ordinate) less MF that the difference is negligible. But MF, from geometry, is almost exactly one-half of CD, the amount of throw. This is because in the triangle ACD, M is the middle point of AC, and therefore AM is one-half of AC, so that MF is one-half of CD. Therefore, BE equals MB less MF; or, in words, the ordinate *after* throwing equals the ordinate *before* throwing, less one-half of the throw. In the same way, it can be shown that the joint (or station) the other side of C (on the right) is similarly affected. Hence, an out throw at any joint increases the ordinate at the joint by the full amount (CD in the diagram) and decreases the ordinates at each of the joints on the two adjoining sides by one-half the amount of the throw. Conversely, if the throw is in, the ordinate at the station thrown is decreased by the full amount of the throw, and the ordinates at the stations on each side are increased by one-half the amount of the throw.

From the above demonstration it is seen that the operation so described consists in the *addition* or *subtraction* from the measured middle ordinate at a station of certain quantity, known as the throw, and in the *subtraction* or *addition* of half that amount to the ordinates at the two stations on either side of the one thrown.

A Simple Example

For example, suppose that at any three consecutive stations or joints of a curve we have the following three ordinates:

18 24 18

These indicate a typical sharp spot, which, of course, it is desired to eliminate by making all three as nearly equal as possible, and thus making a uniform curvature. We can "throw" the middle joint in by subtracting a certain amount and adding half as much to the two figures 18 on each side. Note: It is obvious that the 24 must be reduced and the two 18s increased, so that all three can be made equal.

We can subtract 4 from 24, which will add 2 to both figures 18. We then have:

18	24	18
+2	−4	+2
20	20	20

Thus, we have equalized all three ordinates and made this section of the curve a true circle, which is one of the purposes of string-lining.

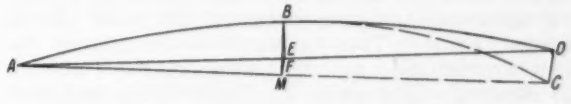
The process of lining a curve (on a slate or a sheet of paper) consists in repeating the above operation at every station, with certain modifications as explained later. It is logical to conclude that from the simplicity of the above operation there must be some definite relation between error and correction; and, in fact, such is the case. However, it is not the purpose of this article to give a detailed mathematical analysis, but simply a set of working rules for the performance of the mechanical operations of string-lining.

In connection with the above rule, it should be noted that the throws at the first and last stations of a curve must be zero. If the first or last stations are thrown, the resulting half-throws will be imparted to the tangent or straight track, throwing it out of alinement. For example, if the first station of a curve has an ordinate of 0, and we throw the track 2 (units of any kind) out, the straight track at the left of the 0 will have a half-throw of -1, which will put a small kink in it. Consequently, we must correct the first station by throwing the second, making the throw such that the half-throw at the first station will correct it.

Relation Between Error and Throw

If, at each station, we add all the errors to and including that station and write them down opposite their station numbers, we obtain a column which we can call the "Sum of Errors." If now we obtain the sum of all of these from the first station to any given station, and write that sum opposite the *following* station, we obtain the half-throw required at that following station.

Let us suppose a curve having 53 stations, opposite each of which is written an actual and a revised ordinate, in two columns, and in the third column the differences, or errors, between the actual and the revised ordinate at each station. Let us now put down opposite the first station the error at that station; opposite the second station, the sum of the first and the second errors; opposite the third station, the sum of the first three errors; and so on, until at station 53, we have the sum of the errors for the entire curve, which must, of course, equal zero. The addition of the errors is algebraic; that is, due regard is taken of the sign of the error. For example, if the first error is (5), the second (-3), and third (-6), the sums of the errors at the first three stations are, in order (5); (5)+(-3)=(2); and (5)+(-3)+(-6)=(-4). It is, of course, not necessary to add all the errors every time, since the sum at any station is obtained directly by adding to the sum of the errors at the previous station, the error at the station. For example, the above would be obtained actually as 5; 5-3=(2); 2-6=(-4); etc., etc.



The Effect of Throw on Adjacent Stations

Having obtained the column headed sum of errors, we next add this column to and including each station and bring the total into the next column under the *following* station. To illustrate (remembering that the throw at the first station is zero), we have for the above figures, the following half throws:

First station		0
Second station	0+5	= +5
Third station	0+5+2	= +7
Fourth station	0+5+2−4	= +3

Once again, it is not necessary to add the figures from the first station on, since the same result is obtained more easily by adding to the sum previously obtained the adjacent figure in the next row. For example:

First station		0
Second station	0+5	= +5
Third station	5+2	= +7
Fourth station	7—4	= +3

A resumé of the above operations may make the process clearer. Consider the following hypothetical curve:

Station or Joint Number	Actual Original Ordinate in Tenths of an Inch	Revised Ordinate for Realined Curve	Error	Sums Errors	Half Throw
1	1	0	+ 1	+ 1	0
2	3	2	+ 1	+ 2	+ 1
3	7	4	+ 3	+ 5	+ 3
4	3	6	- 3	+ 2	+ 8
5	4	8	- 4	- 2	+10
6	7	8	- 1	- 3	+ 8
7	10	8	+ 2	- 1	+ 5
					+ 4

In the first column are the station numbers.

In the second column are the middle ordinates of the actual curve, measured in the field as outlined in the second article.

In the third column are the revised ordinates selected for the curve, in accordance with certain principles explained later.

In the fourth column are the errors, e, obtained as explained above. For instance, at station 3, 7—4=3; at station 5, 4—8=-4; etc.

In the fifth column are the sums of the errors to and including each station. These are obtained by writing down the error at the first station, and then at each station thereafter writing down the sum of the preceding figure and the figure on the next line in the column headed "Error." Thus writing down 1 in the first station, we next add 1 and the 1 shown on line 2 as error at station 2. This makes 2. To this 2, we add the 3 on the next line below, in the error column, making a total of 5.

In the sixth column are the half-throws. To obtain these we add horizontally instead of diagonally downward as we previously did to obtain the sum of the errors. Thus, 0+1=1, at station 2; 1 plus the 2 at station 2, is carried as 3 and written under station 3; 3 plus the 5, at station 3, is written as 8 at station 4, etc. The arrows indicate the direction of the additions and the position of the results.

In this way a final half-throw is obtained at the last station. This half-throw must be zero, as we have seen above. However, because it is nearly impossible to pick the correct ordinates at the first trial, this half-throw will not generally be zero, and we must make it so.

Method of Making Half-Throw at Last Station Equal to Zero

It can be shown that the sums of the products of the error at each station by that station number must be equal to zero, which is a condition that the curve is lined. That is, if at a given station the error (difference between the actual and the revised ordinate) is -5, and the number of the station is 21, the product of these two quantities, is -105. The sums of all such products for the entire curve must equal zero as a condition that the curve is really lined.

It can likewise be shown that the sum of all these products is equal to the half-throw at the last station, whether that half-throw is zero or not. This being the case, it is immediately evident that if the final half-throw is not equal to zero, it can be made so by making equal to zero the sums of the products above referred to.

If we have a certain curve, of any number of stations, and we find that the final half-throw is not equal to zero, but some such number as, say, 46, let us consider a way of changing that 46 to zero. Let us say that the ordinate at the 5th station is 23 on the original curve and 25 on the revised curve. The difference is -2; the product of -2 and the station number, 5, is -10. Now let us say that the ordinate at some other station, as the 37th for instance, is 31 on the original curve and 26 on the revised curve. The error is +5; +5 times 37= +185.

If, now, we change the revised ordinate at station 5 from 25 to 24, and that at station 37 from 26 to 27, we have kept the total of the ordinates the same, for we have subtracted one at station 5 and added one at station 37. But what effect has this had on the products of the error and station number? The error at station 5 is decreased from -2 to -1, making the product now -5 instead of the previous -10; at station 37, the error is decreased from +5 to +4, making the product now 148, instead of the previous 185. Thus, while maintaining the total of the ordinates of the revised curve the same, we have changed the total of the products from the first +175 (-10+185) to the second, 143 (148—5); that is, we have *decreased* the final half-throw by an amount equal to 175—143, or 32. This leaves the final half-throw now 14 (46 -32). The same process can now be repeated, the only difference this time being that the station numbers of the ordinates changed must be different. The reader will note that the net difference in the sums of the products, which amounts to 32, is the difference between the station numbers of the revised ordinates which were changed; that is 32=37 -5. This will always be the case. Consequently, to diminish the final half-throw by the remaining 14, we have but to choose two stations whose numbers differ by 14, and repeat the above process, with the assurance that the final half-throw will now be zero, and the curve will be lined.

The rule for changing the final half-throw to zero can now be announced. It is:

When the final half-throw is positive, subtract from the revised ordinates having high station numbers and add an equal amount to the ordinates having low station numbers, choosing stations in pairs such that the sum of the differences of the station numbers taken in pairs equals the numerical amount of the final half-throw. When the final half-throw is negative, reverse the procedures, subtracting from the ordinates having low station numbers, and adding to those having high station numbers.

Thus, if we have a curve of 63 stations, wherein the final half-throw, obtained with a trial set of revised ordinates, is 59, we could add 1 to the revised ordinate at station 6 and subtract 1 from the revised ordinate at station 48, thereby making a difference of 48-6 or 42, in the final half-throw. We could then repeat the process, choosing this time stations 8 and 25, whose difference is 17, which difference, added to the previously obtained 42, makes the total of 59 and reduces the final half-throw to 0.

The reader will note that the only condition attached to the above method of change is that the sum of the differences of the station numbers of the revised ordinates changed must equal the final half-throw. The operator, therefore, is wholly at liberty to choose the stations which he will change. This is a valuable prop-

erty of the system—one which cannot be over-emphasized, as its understanding enables the operator to obtain a much better solution than he otherwise would be able to achieve.

Two Freak Water Facility Failures

By E. M. GRIME
Engineer Water Service, Northern Pacific, St. Paul, Minn.

THE WEATHER conditions prevailing throughout the Northwest during the recent winter made a busy time for those railway men directly concerned with operating conditions. After a period of ideal fall weather, an unusually heavy snowfall was followed by a sudden cold snap, with temperatures ranging from 25 to 45 deg. below zero over the entire section from the head of the Great Lakes as far west as Spokane, Wash. This, in turn, was followed by a warm spell that caused the ice to go out in such streams as the Big Horn, Tongue, and Yellowstone rivers in Montana, with serious ice gorges which endangered railway embankments at several places and forced dwellers in the low lands to flee for safety.

Among those most intimately concerned when weather conditions become severe are the men responsible for the supply of water which is so essential, and at the same time so sensitive to low temperature conditions. Even though every ordinary precaution may have been taken in the way of protection against cold weather, unusual situations are liable to arise which may be classed as freaks, and two of those described here may be of some interest.

The water station at Heckman, Mont., is supplied by gravity flow from a small reservoir created by a dam which impounds water from springs as well as what little surface run-off occurs in that rather arid region. The supply tank is located about two miles from the reservoir, and under ordinary conditions the comparatively warm temperature of the reservoir water, maintained by the flow through the pipe line which has a good earth cover, keeps the water in the tank at such a temperature that there is little trouble from freezing. Owing to the limited supply at the reservoir, it is necessary to make use of a float valve in the storage tank to shut off the flow as soon as the tank is filled, rather than to let the water run to waste as is customary in mountain districts where an ample flow is always available. During the recent cold snap something happened to prevent the proper functioning of this shut-off float valve and, as the water continued to flow into the tank, it rose slowly above the tops of the staves and into the roof space until this was filled up to the pinnacle of the roof. The cable by which the tank outlet valve is operated became frozen in the ice and then no water could be taken from this "more than full" tank.

A repairman, sent to investigate, after opening up the roof hatchway, found a solid coating of ice covering the under side of the roof, and as he broke through this, he was almost washed off the tank by the rush of water which spouted out. It is evident that the slowly rising water formed a coating of ice on the underside of the cold roof surface, thus making a water tight compartment.

A second freak accident occurred at the 150,000-gal. elevated steel storage tank at Glendive, Mont. Here the tank is filled by a direct pipe line from the city filtration plant, located about three-quarters of a mile distant, an electric alarm gong actuated by a float in the tank notifying the operator when the tank is filled to capacity. The cold water from Yellowstone river, after having been settled and filtered in the warm filtration plant, has a temperature of about 40 deg., and it appears that during the extremely cold spell the vapor arising from this water froze, completely filling with ice the vent holes in the finial ball of the steel roof and also effectually sealing any air openings that existed around the roof hatchway cover. As the tank was full during the night, when little water was being drawn off, a layer of ice several inches thick and sufficiently strong to be self-supporting formed across the top of the tank. When the water was drawn off, a vacuum was created under this layer of ice, and when the tension reached the breaking point, the ice collapsed. The roof, being of steel plate construction, only $\frac{1}{16}$ in. thick and curved to a rather flat arch, was not able to withstand this sudden change of air pressure and about one-half of it collapsed. This tank was built new in 1923, and since there was no evidence of serious corrosion when it was cleaned and painted last fall, the above seems to be the logical explanation for this rather unusual failure.

Derailment at Trailing Frog Blamed on Lack of Guard Rail

THE locomotive of an east-bound freight train of the Cleveland, Cincinnati, Chicago & St. Louis was derailed at a trailing frog, the guard rail of which had been removed, on the tracks of the Dayton Union Railway at Dayton, Ohio, on November 29, 1927, while running at from 12 to 18 miles an hour. After the derailment the locomotive collided with a passenger train on an adjacent track, resulting in the death of one passenger as well as the injury of two other passengers, four dining car employees and two Pullman porters. An investigation conducted jointly by representatives at the Bureau of Safety of the Interstate Commerce Commission and the Ohio Commission of Public Utilities attributed the accident to rough track at the frog in conjunction with the absence of the guard rail.

The frog is located on a compound curve on the Dayton Union track, the curvature varying from 1 deg. to 5 deg., and the investigation disclosed that the track in its vicinity was poorly drained, with evidence of churning ties, and that the superelevation of the track was irregular, being ½ in. at the point of frog, 1¼ in. at the heel and ¾ in. at a point 4½ ft. west of the heel of the frog. It was also found that the guard rail opposite the frog was not in place, the section foreman stating that on learning that the trains would not be run against the current he had removed the old guard rail with the intention of installing a new one, adding that he considered it safe to operate trains over a trailing frog without a guard rail at a speed of 15 miles an hour, to which trains are restricted on tracks of the Dayton Union.

In concluding its report of the accident, the Bureau of Safety said: "Not only is it probable that the accident would not have occurred had the track been properly maintained, but it is even more probable that the accident would have been prevented had the guard rail been in place, properly spaced from the stock rail."

Modern Equipment Expedites Work on Line Revisions

Great Northern Effects Marked Economies in the Performance of Work by the Use of Labor Saving Devices

RAILROADS of the present day are often confronted with the necessity of revising alinement and grades established when the traffic to be handled would not warrant the outlay necessary to secure a better location. These revisions are often of considerable magnitude and require heavy outlays of money, while in other cases they may be of small extent. Further, in some cases, particularly where bridges, snow sheds and tunnels are concerned, it has been found more economical to make these changes than to continue the operation of the old line, from the standpoint of maintenance and renewals alone, entirely aside from the benefits to be gained by the operation of the revised line.

In carrying on such work it is essential that it be done economically, and here the development of power machines and equipment has made possible a wide choice of work equipment best fitted for the local conditions to be met. This is exemplified in several projects of this kind which were completed recently on the Great Northern. While the work was not of large magnitude, careful studies of the requirements permitted it to be accomplished economically.

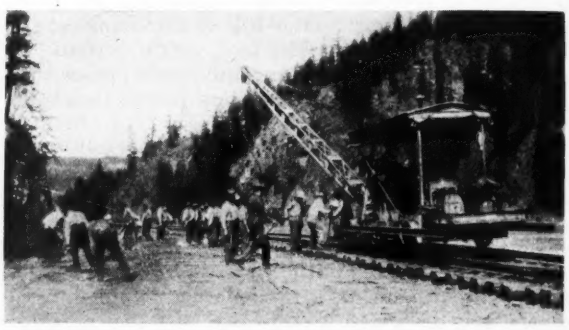
On two of these line revisions, revolving power shovels mounted on crawler treads were used in the excavation, which was all of solid rock. Aside from

Unloading Caterpillar Shovel from Main Line

the saving effected in both money and time by the elimination of the pit tracks for the shovels, further economies were realized by unloading the shovels from the main line with a wrecking derrick, after which they proceeded overland under their own power to the points where they were to bring their work.

One of these line changes was about 1½ mi. east of Lamona, Wash., and involved the excavation of two cuts containing a total of 43,000 cu. yd. of solid rock, with an average haul of 2,800 ft. to the dump. On this work a Bucyrus 65-ton steam shovel with a 1¾-cu. yd. dipper was used, loading the excavation into narrow-gage dump cars hauled by gas-electric locomotives. Double shifts were employed and the entire loading, hauling and dumping force consisted of two foremen, two steam shovel engineers, two cranemen, two firemen, six pitmen, four gas-electric enginemen, four brakemen and eight dumpmen, a total of 30 men, or 15 men to each shift.

The rock was blasted ahead of the shovel by air drills, two Ingersoll-Rand compressors being used to force air into a line from which connections were



Laying Track on Line Revision Near Tunnel No. 10

made to the drills. Coal for the steam shovel was taken from cars placed on a spur near the end of the cut, the coal being loaded into the narrow-gage dump cars and transferred to the shovel during the meal hours to avoid delay to the operation of the shovel. Water was supplied to the shovel from a small tank set up on top of the cut, with a pipe line extending along the upper side of the cut, the water being pumped into the tank from a water car placed on a temporary siding adjacent to the main track.

On another line revision, about three miles west of Irby, Wash., a caterpillar-type revolving Bucyrus shovel with a Diesel engine was used. This shovel weighed 35 tons, had a one-yard dipper and required only two men for its operation—an engineer and a pitman. It consumed from 4½ to 5½ gal. of oil per hour. Single shifts were used on this job, the total excavation being 15,000 cu. yd. of solid rock, with an average haul of 1,000 ft. The new line has maximum curves of 2 deg. as compared with a maximum of 6 deg. on the old line, and was completed at a cost of $65,000, its construction eliminating the necessity of rebuilding three bridges at a cost of $85,000.

The Diesel shovel was of the same type that is used by the Great Northern for loading ballast or other material where the length of the face is sufficient to enable enough empty cars to be placed for a day's loading, thus saving the expense of a spotting crew and making a marked reduction in the cost of loading. This method was described in the report presented at the convention of the Roadmasters' Association by the Committee on Means of Reducing Work Train Service, published in *Railway Engineering and Maintenance* for October, 1927.

Revolving Caterpillar Shovel Excavating Rock Cut

Another line change was made near Tunnel No. 10 in the Kootenai canyon, not only for the purpose of reducing curvature and eliminating a short tunnel, but also to eliminate the hazard of falling stones from the hills and bluffs adjacent to the old main track. On this work a Parsons rail crane was of material assistance in laying the new track.

We are indebted for the above information to J. J. Hess, general roadmaster on the Western lines of the Great Northern, under whose supervision this work was done.

Miniature Gardens Beautify Bumpers

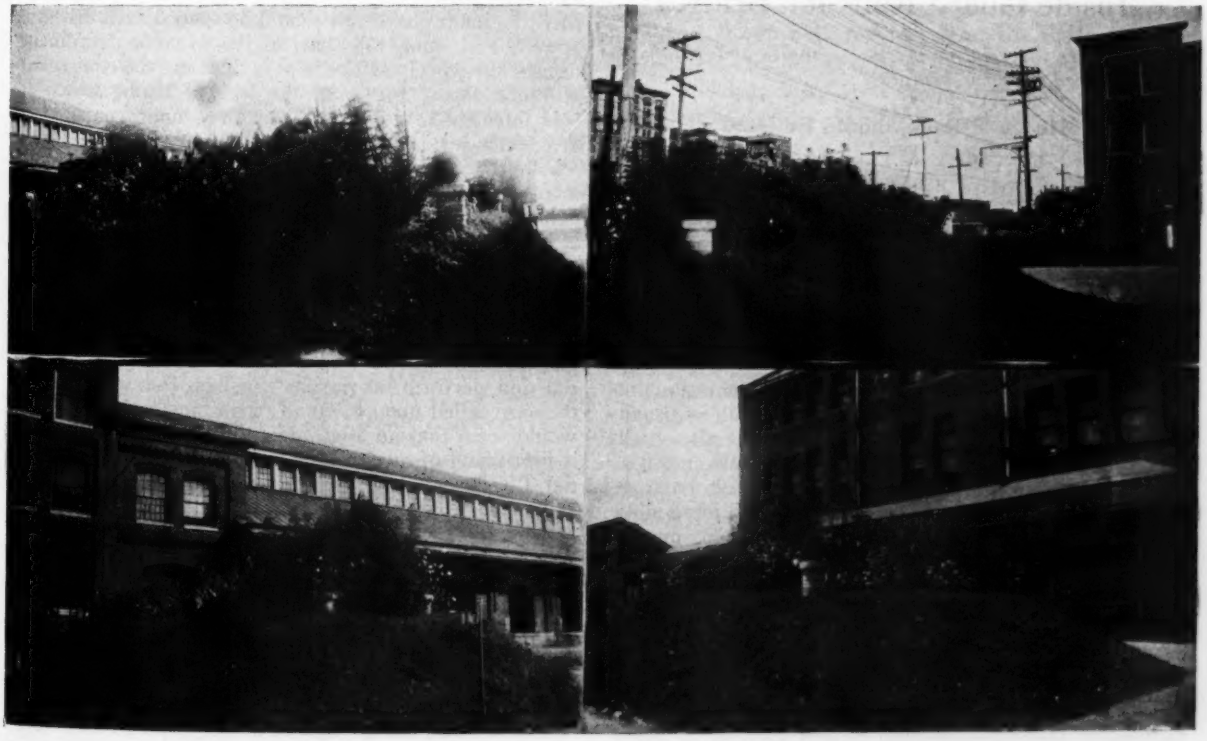
EARTH mounds are still used as substitutes for bumping posts and car stops by numerous railways where the conditions will permit, although they are usually blotches on the right-of-way, particularly in the vicinity of otherwise attractive station grounds. A way of overcoming this objectionable feature of the earth bumper, and one which is quite effective, is illustrated in the accompanying views, which show the measures taken by the local division forces of the Atlantic Coast Line at Richmond, Va.

These views show earth bumpers in the vicinity of the Atlantic Coast Line freight house at Richmond, which have been carefully shaped, turfed and planted to enhance their appearance. Like the usual bumper of this type, those illustrated are oblong in shape and are terraced up to a height of about five or six feet, leaving a substantial level area across the top.

As now beautified, the side slopes of the mounds are turfed and the top surface is planted into a miniature flower garden. In this garden the background is usually formed of pink chrysanthemums and Euphorbia, the latter being commonly known as "Snow on the Mountain"; the center is occupied by a circular bed of cannas; and the foreground is filled out with cockscombs, asters, petunias, zennias, cosmos, gladiolas and a few scattered rosebushes. These particular flowers, which are used in this work because of their frequent blooming qualities, and because they require little cultivation, are so arranged as to present their best appearance from the point of most frequent observation.

In some instances the corners of the mound gardens are set out by flower urns made up of painted sections of tile pipe, with the bell end upward, and within which plants or ornamental shrubs have been planted.

We are indebted for the information contained in this article to E. P. Laird, superintendent of the Atlantic Coast Line at Richmond, who has taken much interest in the beautifying of the Coast Line's grounds at Richmond.



Miniature Flower Gardens Beautify Earth Car Bumpers on the A. C. L. at Richmond, Va.

What's the Answer?

What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities

QUESTIONS TO BE ANSWERED IN THE MAY ISSUE

1. *When plowing off dirt with a side plow for widening banks on multiple track lines, what can be done to prevent material from falling between the tracks? What is the best method of removing such dirt?*

2. *What is the best method of providing superelevation of the track on bridges on curves?*

3. *When using bank-run gravel, what is the best method of disposing of stones too large for ballast?*

4. *Does the use of salt for removing snow or ice from brick platforms have any bad effect on the bricks?*

5. *Should runways between the rails and adjacent to the track be provided at motor car or hand car set-offs? If so, should they extend across both tracks of double track lines? What form of runway is best for this purpose?*

6. *What are the relative merits of force pumps and ordinary hand pumps where the water supply for small stations is obtained from shallow wells?*

7. *When shipping in discarded materials should the track foreman attempt to separate scrap from usable material or should this be done at a central point?*

8. *What is the best method of removing old piles standing in water when it is impracticable to pull them?*

Inside Guard Rails for Bridges

What are the relative merits of angles and T-rails as inside guard rails for bridges?

Heavy T-Rails Should Be Used

By P. G. Lang, Jr.
Engineer of Bridges, Baltimore & Ohio, Baltimore, Md.

Inner guard rails should never be confused with outer guard rails, which are usually of timber. The function of the outer guard rail is to space the ties properly and to keep them so spaced under all conditions so that they will, under such conditions, perform their function as a beam in distributing the vertical loads coming upon them.

The inner guard rail performs a different function. While it is true that an inner guard rail is usually thought of in connection with bridges, it is also vitally necessary in other situations, such as tunnels and other places where serious consequences will result from derailments. Inner guard rails should be used in all situations where the consequences of a derailment may be serious, and hence where it is necessary to minimize these effects by attempting to prevent derailments and, in the event of derailment, holding the equipment in line until it can be brought to a standstill.

Considering these conditions, it would seem that the inner guard rail should be capable of supporting vertical loads which are brought upon it, that its top surface should be reasonably smooth so that portions of equipment which may be dragging will not catch and cause derailment, and that, in the event such equipment does drag, the inner guard rail will support the loads. Further, the inner guard rail should be spaced such distance from the running rail that, in the event a derailment occurs, the wheels will be kept in line, and the equipment will not depart far from the line of traffic which it was intended to follow. Therefore, inner guard rails are extended some distance beyond the structure, whether bridge or tunnel, in order that, if the derailment occurs before the structure is reached, the derailed equipment will be held in proper line.

Under these circumstances, an inner guard rail is essentially a safety and insurance measure. Its cost is comparatively small in relation to the total cost of the structure and in relation to the consequences which may occur. It would, therefore, seem that if such guard rails are to be used at all, they should be substantial and perform, as far as possible, the work which they are called upon to do. Considering these things, it would seem that an angle used for an inner guard rail is flimsy and of questionable utility, and that a substantial T-rail should be used for inner guard rails.

T-Rails Are Preferable

By Supervisor of Bridges

While inside guard rails of heavy angles have been used to some extent on large bridges, they seem to have no advantage over T-rails, except possibly in appearance, while their cost is considerably higher, due to the fact that relay rail may be used for such purpose with satisfactory results.

The physical characteristics of the rail used may vary somewhat with the stress that may be laid on appearances. Considered solely from the standpoint of safety,

it is sufficient that the rail be sound, reasonably straight and the faces adjacent to the running rail be uniform. It is essential that the joints be well bolted, with no "lips" at the joints, and that the rails be of the same height at the joints to eliminate projections which might offer obstructions to derailed wheels or dragging equipment, causing them to tear out the guard rail. However, since the extra cost of a good quality of relay rail is small, such rail should be selected.

The rail used should be the same height as the running or not more than an inch lower, and should be spiked securely to every tie. The importance of the function performed by the guard rail in case of accident is too great to permit any cheese-paring economies in its installation or maintenance.

Handling Lime or Soda Ash

What precautions should be taken to avoid irritation of the skin when handling lime or soda ash at water treating plants? What remedies will relieve such irritation?

Wear Gloves or Use Vaseline

By H. W. Van Hovenberg

Sanitary Engineer, St. Louis Southwestern, Texarkana, Tex.

If the plant operator's hands will not stand handling of lime and soda ash with thorough washing and drying of his hands after handling chemicals, then it would be best for him to wear gloves or to replace the natural skin oil by applying vaseline or lanoline before and after handling. There is probably more chance of danger to the operator through inhaling dust than through handling of the chemicals.

Will Vary with the Individual

By Superintendent of Water Service

There is a great difference in the susceptibility of different individuals to irritation from lime or soda ash and the protective or remedial measures to counteract this condition will vary accordingly. With some it is necessary only to wear gloves when handling these materials, while others may find it necessary to apply vaseline or some kind of a salve both before and after exposure. Goggles should be worn to protect the eyes, and where discomfort is caused by breathing the dust, pledgets of loose cotton should be inserted in the nostrils to prevent entrance to the nasal passages.

Maximum Loads for Motor Cars

Is it desirable to advise foremen as to the maximum loads to be placed on motor cars? How can this information best be transmitted where cars of various load-carrying capacity are used on the same railroad?

Load Capacity Should Be Stenciled on Cars

By C. R. Knowles

Superintendent Water Service, Illinois Central, Chicago

It is very desirable that foremen be advised as to the maximum permissible loading of motor cars. This information can best be transmitted to the foremen and others concerned in motor car operation by stenciling the load capacity on the car. Supervisory officers should see that the instructions as to loading are complied with.

The principal factor governing the loading capacity of motor cars is the size of axle. The majority of motor cars are equipped with a 1½-in. axle, and in order to avoid confusion or possibility of overloading, the uniform permissible loading should be established for section cars and other cars of similar type, based upon the safe carrying capacity of 1½-in. axles. Light inspection cars are usually equipped with 1¼-in. axles, and the same procedure should be followed with this type of car. When heavier cars having axles of 1¾ in. and larger are used a similar procedure should be established. In other words, motor car loading should be based upon the axle size. For example, a safe loading for various size axles is as follows:

1¾-in. axle	2,000 lb.
1½-in. axle	1,200 lb.
1¼-in. axle	650 lb.

It should be understood, of course, that the speed of the car and the condition of wheels and axles are important factors in determining the safe carrying capacity of the car. For example, a load that would be safe at 15 miles per hour with wheels and axles in good condition would be an unsafe load at 25 miles per hour, or with worn wheels and axles.

Stencil Cars to Show Maximum Load and Number of Men

By J. A. Heaman

Chief Engineer, Grand Trunk Railway System, Detroit, Mich.

It is desirable that both foreman and men be informed as to the maximum loads which should be placed on motor cars, and I believe that this can be done by having stenciled on the cars the maximum load which should be placed upon them in pounds, also the number of men hauled which would load them to capacity.

Rusting of Track Fastenings

What conditions tend to accelerate the rusting of track fastenings, aside from brine drippings? What can be done to counteract these tendencies?

Keep Ballast Away from the Rails

By G. M. O'Rourke

Roadmaster, Illinois Central, Carbondale, Ill.

Aside from brine drippings, the conditions which tend to accelerate rusting of track fastenings are poor drainage, swinging, sloppy joints, accumulation of cinders or other ballast against fastenings, and weeds. To counteract the causes of rust effective drainage must be provided; muddy ballast removed from swinging joints and replaced with clean, dry ballast after building the embankment wide enough to hold the ballast to overcome center binding. Where sloppy joints are in cuts, tile drainage as well as ample clean surface ditches should be provided.

Ballast must not be allowed to remain piled against the base of rail and fastenings, as moisture is retained and corrosive action started, especially where cinder ballast is used. The weeds should be cut to let the sunlight in against the track and the fastenings should be oiled regularly.

Keep the Rails and Fastenings Free from Dirt and Cinders

By L. B. Holt

Engineer of Track, New York Central, Cleveland, Ohio

One of the causes of accelerated corrosion of track fastenings, aside from brine drippings, is the accumulation of earth, dust and cinders around tie plates, splices and spikes through station grounds and especially in yards and congested terminals. The obvious

remedy is to keep the track clean and the ballast dressed lower than the tie surface. The normal force allowance is seldom sufficient to remedy this condition entirely unless augmented at intervals for a thorough cleaning or renewing of the ballast.

The gas and smoke laden air of factory and engine terminal districts has a marked corrosive effect on track fastenings. Annual spraying of the rail and fastenings with a heavy asphalt-base oil will retard this destructive action and the use of copper bearing steel in bolts, spikes and tie plates will also prove beneficial. When cinder ballast is employed corrosion of track fastenings will result unless special care is taken to dress the cinders well below the surface of the ties so as to avoid all contact with the metal track structure.

Various Conditions Are Responsible

By V. H. Shore

Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

Aside from brine drippings, most of the rusting of track fastenings is caused by allowing dirt and cinders to accumulate to the extent that the joints, bolts, tie plates and spikes are partly or wholly covered, thus retaining moisture. This condition is most noticeable in yards where the track is filled to the level of the top of the ties and can be taken care of by cleaning off the dirt.

Another condition is poor drainage which prevents the water getting away quickly after a heavy rainfall, keeping the fastenings damp for a considerable length of time. The remedy for this, of course, is to improve the drainage. Considerable corrosion is also caused to the fastenings at turnouts by the use of salt for melting snow and ice from the switch points and rods, and this can be avoided by using some of the other methods now available for this purpose.

Anchor Bolts for Posts on Concrete

In placing anchor bolts for posts on concrete structures, should they be installed by template as the concrete is deposited or should holes be drilled to receive them when the railing is set?

Bolts Should Be Set in the Concrete

By Office Engineer

While it is generally found preferable to drill holes for the anchor bolts of bridge shoes, there are a number of reasons why it is more economical to set the anchor bolts for hand rails so that they are concreted in place. Foremost among these reasons is the fact that so many bolts must be set for a railing of even moderate length, which means that the cost of drilling holes for such bolts even with power drills is likely to be high. Another point to be considered is the complication introduced by reinforcement in the concrete and the difficulty of keeping the bars near the surface of the wall, parapet or walk away from the location of the anchor bolts.

In contrast with these objections to drilling holes for anchor bolts is the relative simplicity of setting the bolts for concreting them into place. All that is necessary is a board or template with four holes spaced to correspond with the hole spacing in the base of the railing stanchion. In most cases, this template can readily be placed in position to span across the width of the wall or parapet and secured in place to the tops of the side wall forms. The width of such a template ought never need to be so great as to introduce any appreciable obstruction to the placing of the concrete, and it can be removed after the initial set has taken place to permit the troweling or floating of the concrete surface.

As many railings are made in such a way that the horizontal rails have slip joints, it is not necessary to have a high degree of accuracy in the spacing of the stanchions. Consequently the template for the bolts needs to be set accurately only as to line; accuracy of their longitudinal spacing is a matter of no consequence.

Another point to be considered is the need for the development of the maximum strength of anchor bolts used in railings. Specifications defining the strength of railings on bridges, particularly on overhead highway bridges, are constantly becoming more rigid. This means that the anchorage of the hold-down bolts should be sufficient to develop the full strength of the bolts themselves, and while the efficiency of many types of anchor or expansion bolts designed for use in drilled holes is high, it is not to be expected that it would be equal to that of bolts concreted in place.

Set Bolts as Concrete Is Placed

By J. B. Hunley

Engineer Bridges and Structures, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio

For most structures, where we set bridge steel, we have found that it is quite unsatisfactory to try to set anchor bolts in advance with a template, and for such work we box out for them or drill them, but with a railing post it is different. These posts usually have pipe railings, and it would ordinarily make but little difference if the post were moved slightly one way or the other, as long as the group of bolts for one post were properly set. It is not difficult to set a group of bolts with a template, but it is difficult to set one group accurately in reference to another, and so, for railing posts, unless some unusual condition obtained, we would expect to set the anchor bolts before the posts were erected, as it is much cheaper than drilling them later, especially where the concrete is reinforced, as is frequently the case where a railing is used.

Establishing a Ballast Toe Line

What is the best method of establishing a uniform ballast toe line? Will the method vary for different kinds of ballast?

An Effective and Economical Method

By G. J. Ray

Chief Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

The most effective and most economical method of building a toe line for crushed stone or washed gravel ballast is to use one or more boards 1½ in. by 6 in. and from 12 to 16 ft. long, together with a gage to measure the horizontal distance from the base of rail to the proposed toe line.

The method of procedure is as follows:

1. Remove the stone from the location where the toe line is to be built and throw it back on the shoulder near the ends of the ties with ballast forks.

2. Level off the location for the toe line to form a berm of even grade approximately parallel to the plane of the top of the rail. It is preferable to build this base or berm of cinders to prevent a growth of vegetation.

3. Place the straight edge on the base that has been provided and at the pre-established distance from the base of the rail. Pull the stone down against the edge

of the board with ballast forks. It is necessary to build a shoulder of uniform slope and section from the ends of the ties to the toe line to obtain the neatest and best results.

4. Move the straight edge to a new location.

5. A curb of cinders or other light material is then put in place of the straight edge to hold the stone in uniform line.

When cinder ballast is used, a suitable toe line can be constructed by using a straight edge and gage and proceeding as above, but no form of curb is needed to hold the toe of the shoulder.

The Work Can Be Done Easily and Cheaply

By L. J. Drumeller

Assistant Division Engineer, Chesapeake & Ohio, Russell, Ky.

The best method of establishing uniform ballast toe line is to cut the roadbed down to uniform elevation below the top of the rail and be sure that the proper width of roadbed is obtained at all points, using a board about 10 in. wide by 1 in. thick by 10 ft. long as a template for the toe line. The inside edge of this board is placed the proper distance from the gage side of the rail, and stakes are driven along the outside edge to hold it in place. It is advisable to pick out the largest pieces of ballast, placing them along the inside face of the template and then forking the ballast down to its proper slope.

I have observed the use of brickbats to establish a more permanent ballast margin, but believe this is an unnecessary expense and that with the proper maintenance the ballast margin can be preserved the year round with the above method, which will not vary with different kinds of ballast.

Wiring New Stations for Lights

In view of the widespread use of electricity is it good practice to wire new stations for electric light at points where current is not yet available?

Depends on Type of Building

By A. T. Hawk

Engineer of Buildings, Chicago, Rock Island & Pacific, Chicago

There are few localities on our road now without a supply of electric current. In case a new station were to be built where current is not available, consideration must be given to the type of building to be erected and the probability of the availability of current in the comparatively near future.

For a brick building or a frame structure of the better class, particularly if the walls are to be plastered, it would be better to install the wiring during construction for it is not likely that a community calling for such a structure will be long without a supply of electricity. For a frame station of the ordinary sort it is more economical to leave the installation of the wiring until such time as it is needed, since the use of exposed conduits permits this to be done cheaply and in a way that is not unsightly.

Each Building Is an Individual Problem

By Supervisor of Buildings

In any passenger station which is to be open regularly for use after dark it is desirable to use electric light if current is available, not only on account of the better illumination afforded but also as a protection from the fire hazard. There are now comparatively few localities without an electric supply and the number is decreasing continually, due to the spread of transmission lines throughout the country.

For this reason, it is often economical to wire stations for lighting at the time they are built, even though no current is available. In arriving at a decision, the cost of installation at the time of construction must be compared with the cost of applying the wires and fixtures at some future date. If it seems advisable to use concealed conduits the cost will be much less if done while the structure is building, and it should be done at that time unless there is reason to doubt that current will be available in a reasonable time.

For small frame stations it is usually satisfactory to use exposed conduits, hence the cost of installation at any time is not great. However, consideration must be given not only to the actual time consumed in doing the work but also the time required to get the men to and from the work when they are sent from division headquarters.

Tie Renewals When Relaying Rail

When new rail is laid, should the tie renewals be made before or after the rail is laid?

Tie Renewals Are Made When New Rail is Surfaced

By G. A. Phillips

Engineer Maintenance of Way, Lehigh Valley, Bethlehem, Pa.

We lay all of our rail, both new and relay, during the winter months. It is necessary in most cases to give the new rail a light running surface, and such ties as may be necessary to be renewed are taken care of at this time to the extent that our track will last for a long period without making it necessary to again disturb it.

Renew the Ties Immediately After Laying the Rail

By D. Rossi

Supervisor, Track Elevation, Chicago & Western Indiana, Chicago

Renewal of ties should be done after the new rail is laid, since if it is done before it means that some of the work must be done over, such as respacing and respiking ties, regaging, and also placing tie plugs in the new ties. In handling rail renewals as general foreman, I preferred to do the laying of new rail, tie renewals and surfacing at one time with a gang large enough to carry on all these in proper order. With a gang of 120 men, 56 were used for laying rail, 8 for disconnecting old rail, and 6 with the rail-loader picking up the old rail and miscellaneous track material. Following these was a tie gang renewing and spacing ties and piling the old ties. A final gang of 30 men surfaced, lined and dressed the track. In this way the work was completed at one time and the work was done uniformly, proving very satisfactory in saving both time and labor.

Ties Should Be Renewed After Rail is Laid

By W. O. Frame

District Engineer Maintenance of Way, Chicago, Burlington & Quincy, Burlington, Iowa

Tie renewals should be made after rail is laid in all cases unless it is reasonably certain that the rail will be laid too late in season to permit tie renewals afterward. It is good practice for ballasting and rail renewal programs to go hand in hand which permits tie renewals to be made in connection with surfacing, effecting sav-

ings in the cost of renewals, and securing a uniform bearing under all ties.

If new rail is not to be surfaced there are also numerous advantages to be gained by making renewals after the rail is laid. The new ties will be spiked only once, whereas they will be subjected to double spiking if put in in advance of rail renewal. Adzing and respiking done in connection with rail relaying damages ties to a certain extent and discloses the weak ties, many of which will be taken out, which would not have been observed before the rail was relaid. In the majority of cases rail relaying changes the location of joints, and by handling tie renewals following the relay it is possible to get good ties under the joints, which is an advantage well worth considering.

Depends on Extent of Tie Renewals

By V. H. Shore

Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

If the tie renewals are heavy they should be made before the rail is laid, since the ties to be removed will not afford a good bearing for the new rail and are likely to cause surface bending of the new rail. If tie renewals are light it is often advisable to make them after the new rail has been laid. When the tie renewals are heavy, say six or eight to the rail, the track should be given a light surface as the ties are renewed, since this will often reduce the time necessary for the work by 75 per cent and will also leave the track in good condition to receive the new rail.

Renew Ties and Surface Track Before Laying Rail

By L. Flynn

Yard Foreman, Southern Pacific, El Paso, Tex.

Not only should tie renewals be made in advance of the laying of new rail but the track should also be put in as nearly perfect surface as possible so as to bring all the ties to an even bearing under the rails. By this method the new rails will not be subjected to traffic on an irregular surface which tends to surface bend them.

It is a common error to rush rail relaying gangs with the thought that if a mile of track is relaid in an eight-hour day with a force of from 70 to 100 men, money has been saved, when in many cases the reverse is true. To lay a mile of track in eight hours, while leaving unfinished enough work for 35 or 40 men to complete the following day, lacks much of really laying a mile a day and in addition often causes much damage to new rail. Ordinarily it is better to lay less rail daily and to lay it right than to rush the work at the expense of quality. If 100 men are used there is plenty of preparation work ahead of the gang for such as are needed continually for handling rail, and these may be brought back to assist in rush work in emergencies.

Advantages in Renewing Ties After Laying Rail

By D. M. Engler

Track Foreman, Electric Division, New York Central, White Plains, N. Y.

When new rail is being laid it is very annoying to find new ties low, as is often the case, at least one-half minute being necessary to bring each one to face before the new rail can be pushed home. Usually after rail renewal it is necessary to space ties conforming to the position of the joints. In performing this operation the new ties would surely suffer, while the roadbed would be doubly disturbed. Furthermore, in some spots it will be found necessary to adz the ties, first, to obtain a firm bearing between the tie plate and rail and, secondly, to seat the rail correctly for even wear. Therefore, for fast work in the relaying operation for the security of the roadbed and for the benefit of the ties, ties should be renewed after the new rail is in.

Renew the Ties Before the Rail Is Laid

By William Corn

Section Foreman, Midland Valley, Grainola, Okla.

Tie renewals should be made and the track put in good line and surface before new rail is laid, since this prevents the new rail from becoming surface bent or line kinked while this work is in progress. After the rail has been laid the track should be gone over to correct any irregularities in line and surface.

Rail Is Laid in Winter and Ties Renewed in Spring

By L. J. Drumeller

Assistant Division Engineer, Chesapeake & Ohio, Russell, Ky.

The tie renewals should always be made after the rail is laid. This practice will require the spiking of the tie only once, whereas if the ties were renewed ahead of the rail laying they would be spiked again when the new rail is laid. On our road it is customary to lay the new rail in January, February and March and begin in April making tie renewals, which has proven very satisfactory.

Doors for Enginehouses

A further answer to the following question discussed in the March issue:

What is the best type of door for enginehouse stalls, from the standpoint of maintenance?

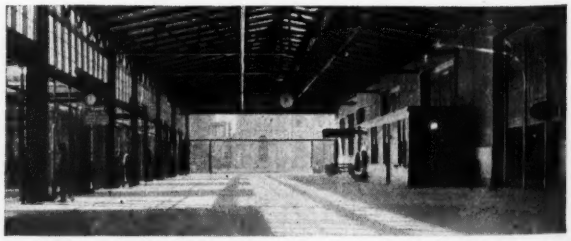
Steel Frame Swinging Door Adopted as Standard

By J. Schofield

Architect, Canadian National, Montreal, Que.

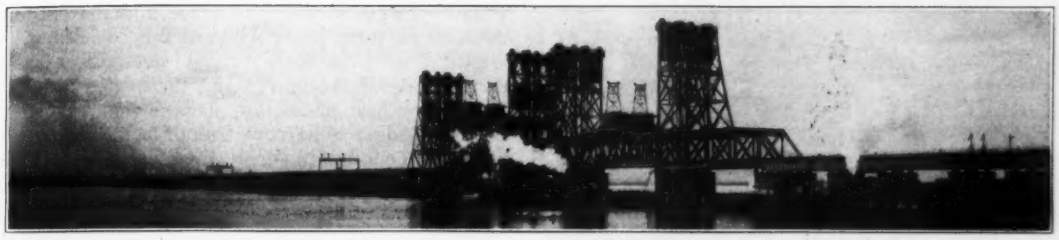
The door adopted as standard by the Canadian National Railways and which we consider the best type we have seen to date is constructed as follows:

The frame is composed of three-inch steel I-beams, which form the top and bottom rails, stiles, girt and brace. In addition to these, a vertical I-beam is inserted between the bottom rail and girt to form a wicket door where such a door is required. All steel framing is welded together, using the electric-arc welding process. Three hinges are placed on each leaf of the door. Two 5-in. by 3½-in. by ¾-in. angles are welded together and to the door stile, and these, in combination with another pair of 4-in. by 3-in. angles, plates, etc., which are bolted to wooden posts between the pairs of doors and adjustable hinge bolts, permit vertical adjustments as required for accurate setting. Two-inch wooden pieces are bolted to the full width of the I-beams and to these are nailed ¾-in. by 3-in. T. & G. V-joint sheathing placed vertically.



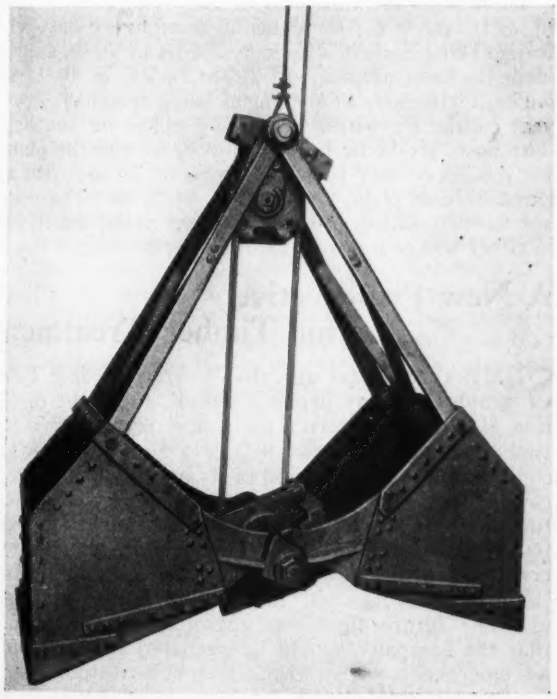
Concourse of the Gulf Coast Lines Station at Houston

New and Improved Devices



A New Orton Clamshell Bucket

A NEW clamshell bucket which has been designed for efficient operation in heavy work and for economy in maintenance has recently been introduced by the Orton Crane & Shovel Co., Chicago, which has designated it as Model V. In this model the sides of the bucket are straight with removable wrought steel lips bolted to the digging edges and provisions are made for applying removable teeth if desired. The interlocking hinges are



The New Orton Clam Shell Bucket

bronze-bushed steel castings riveted to the scoops to eliminate bending strains in the main closing shaft, which is made in three sections so that only the center section carrying the sheaves needs to be threaded when replacing worn bushings.

Removable bronze bushings are used throughout the bucket and these are equipped with Alemite-Zerk fittings to provide means for the positive injection of lubricants under high pressure. Straight lead sheaves are used to keep the cable in the bottom of the score and thus to eliminate side wear on the sheaves and to prolong the life of the cable. Case-hardened wearing blocks, which may be replaced when worn, guide the cable and keep it from cutting the bucket. The buckets are built with one or two closing lines and one or two opening lines and it is said that the closing action is rapid, affording speedy operation, which is aided by the smooth surfaces of the inside of the bucket.

The Model V bucket can be furnished in capacities ranging from ½-cu. yd. to 5 cu. yd. and with weights ranging from 2,500 lb. to 12,400 lb.

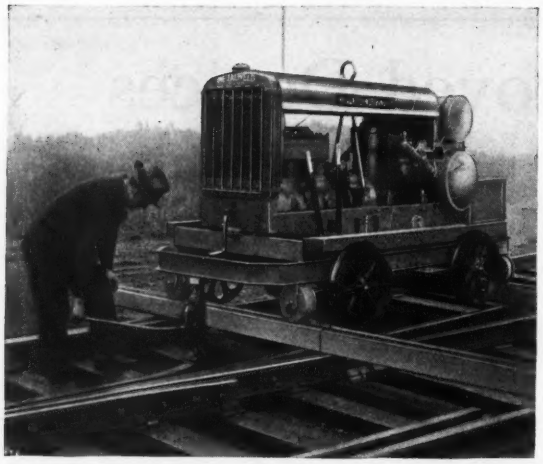
New Rail-Car Air Compressors

METALWELD, INC., Philadelphia, Pa., has recently put on the market a new line of portable air compressors designed specifically for railroad work, known as the Metalweld-Worthington "Air King" series of rail-car air compressors. These new compressors, which are intended for a wide range of construction and maintenance work, are made with displacements of 110, 210, 280 and 330 cu. ft.

In general, the two large models, which are self- propelled and designed for operating 12 and 16 tie tampers respectively, consist of a three-cylinder Worthington compressor, direct connected to a water-cooled, low-speed, heavy-duty Wisconsin engine. These main units, together with their accessories and the fuel and air tank, are mounted on a heavy rolled steel, welded frame. Special features of the new 280-ft. and 330-ft. compressors include forced-feed lubrication; Laidlaw feather valves and a counterbalanced crank shaft; bevel gear transmission; grease-packed ball bearing journal boxes; and cast steel wheels. Other features of the larger units include thermostatic engine control, automatic throttle, ball bearing friction drive clutch, electric starter, and a hydraulic lifting jack for use in setting the compressor off from the track or in moving it transversely from one track to another.

This latter unit of equipment consists of two cylinders mounted at about the center of the side frames of the compressor car, and connected with a small hand plunger pump and oil reservoir mounted on the running board. Twenty-five strokes of the pump lift the car three inches above the rails and permit the ready placing of derailing tracks under the transverse wheels provided at each end. A lifting bale is also provided for moving the compressor about with a locomotive crane.

The two smaller capacity rail-car compressor units of 110 and 210 cu. ft. displacement, differ from the larger capacity units described principally in that they are

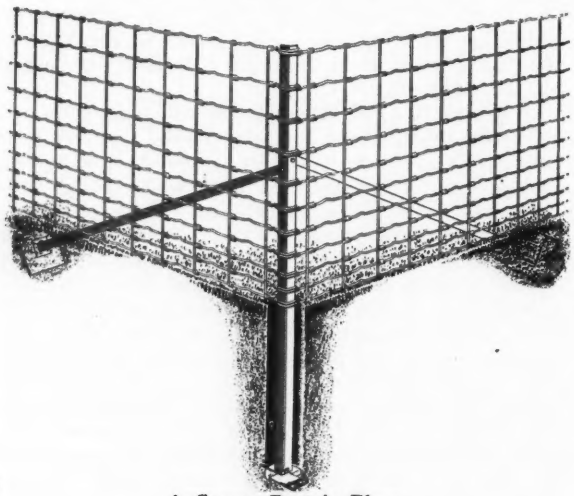


One of the Larger Metalweld Compressor Models

equipped with Continental Red Seal engines rather than Wisconsin engines, and ordinarily are not equipped with the hydraulic lifting jack. These smaller units have capacity for operating four and six-tie tamping tools respectively. All four Metalweld rail-car models can be furnished for direct connected electric drive if desired.

Novel Anchor for Steel End and Corner Fence Posts

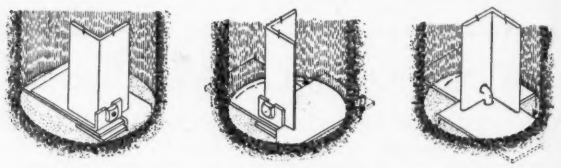
THE American Steel & Wire Company, Chicago, has introduced an angle steel fence post for use at ends and corners which is provided with an expanding steel anchor for engaging solid earth when the post has been set, thereby obviating the use of concrete and permitting



A Corner Post in Place

the post to be set quickly and cheaply with no special tools. The anchor consists of two steel plates fastened to the bottom of the post, folded together so that the post can be lowered into place in an auger hole. These plates are so arranged that when the post is turned clockwise, which can be done with the aid of the steel brace with which the post is equipped, the plates are revolved, causing their ends to force their way into solid ground outside the hole and thus to act as anchors for the post. After the plates have been spread to their full extent the post can be turned in the same direction as much as is necessary to bring it to its proper position for receiving the fence wires. The posts can be set readily in holes eight inches in diameter, but if desired they may be placed in holes five inches in diameter by squaring the hole with a bar sufficiently to admit the anchor plates.

The end posts have one brace and the corner posts two braces, these being made of 2-in. by 2-in. by ¼-in. angles, 7 ft. 8 in. long. Large steel plates are bolted to the ends of the braces and the braces are anchored by driving these plates into place in undisturbed ground with a sledge, a narrow trough being cut under the brace deep enough to permit the plate being driven until its top edge is two or three inches below the surface of the ground. The braces are punched at both ends



Progressive Views of the Setting of the Anchors

and are interchangeable, permitting their attachment for either right or left hand stretches of fence. Special secondary braces can be furnished for intermediate posts when it is desired to brace a post in both directions in the fence line. Special gate fixtures may also be supplied for hanging steel gates on the end posts.

These posts are furnished in lengths of 7 ft., 7 ft. 6 in., 8 ft. and 9 ft., for either light or heavy duty, the former being made of 2½-in. by 2½-in. by $\frac{3}{16}$-in. angles, while the latter are made of 2½-in. by 2½-in. by ¼-in. angles, the corners of the angles being rounded to prevent cutting the wires. The brace plates for the light duty posts are 12 in. by 12 in. by $\frac{3}{16}$ in. and the plates for the heavy duty posts are 16 in. by 16 in., with an extra stiffener plate, 4 in. by 4 in. by $\frac{3}{16}$ in. The posts are finished with a preservative steel paint, baked on, in either willow green or battleship gray colors.

A New Preservative for Timber Treatment

SOME three years ago the Western Union Telegraph Company began a search, under the direction of Dr. L. P. Curtin, for a new preservative for timber, being prompted to this action by its vital concern in the preservation of its poles, which aggregate at least seven millions and which, from the nature of their service, are exposed to influences hastening decay. Due to the increasing demand for creosote, as the supply of naturally durable timber diminishes, it was felt that a shortage of creosote at some future time was reasonably possible and that the company should be prepared to meet such an emergency with an effective substitute. When the less durable timbers are used it is necessary to treat the poles full length, and it has been found that the creosote required to treat pine poles to the company's standard costs as much as the untreated pole.

Dr. Curtin's first activities consisted of original research relative to the various fungi which cause timber decay. He found that all decay organisms, at least all of those which are of commercial importance, produce or secrete juices which have acidic reactions. He then undertook to determine whether these juices could not be utilized to dissolve toxic

chemicals which are normally insoluble in water. It has been generally recognized in the wood preserving industry that a preservative cannot be effective unless it is sufficiently soluble in water to exert a poisonous effect on fungus organisms. Hence, it has been deemed impossible to utilize a permanent, insoluble material for wood preservation, because such a material would have no effect on the decay organisms. However, if a fungus, by acidic secretion, could itself dissolve such materials, it was obvious that there might be certain chemical compounds which would be so insoluble in water as to be permanent, and yet so toxic as to be effective in killing fungus organisms and preventing decay.

The succeeding investigation, therefore, involved the study of a whole series of chemicals and chemical compounds to determine which ones possessed the necessary toxic and insoluble properties and were also obtainable in large enough quantities and at a low cost. Several interesting possibilities were discovered, but the one material which was found to fulfill all requirements best was zinc meta-arsenite. Not only is this said to possess all the essential properties of a permanent, inexpensive preservative, but it is also simple to use, non-corrosive to steel, and of low electrical conductivity. Its toxicity is also said to be higher than that of any other preservative commercially used today, while the chemicals for producing it are available in abundant quantities.

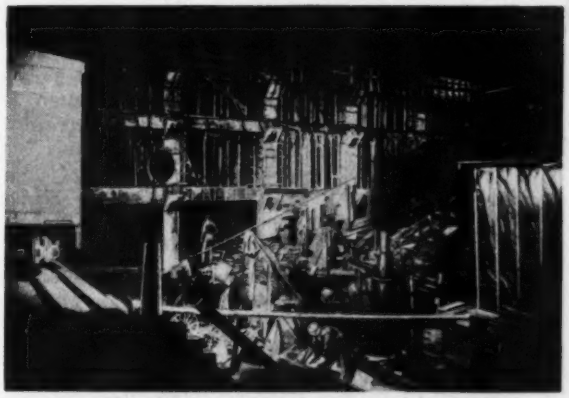
Even though zinc meta-arsenite was thus proved in the laboratory to have a correct scientific foundation and to possess valuable properties as a wood preservative, it was still necessary to develop accelerated tests which would demonstrate in a short time the results that should be expected over a long period of years. To corroborate these laboratory results, the Western Union Telegraph Company, therefore, made extensive accelerated tests of the new wood preservative, including leaching tests to demonstrate the effectiveness of the new material to resist loss from water and rain, and the outdoor exposure of treated wood to sun, rain, wind, temperature changes and frost. These tests are said to have shown that zinc meta-arsenite is permanent in the wood and that it retains its full effectiveness against decay organisms. On the basis of these facts the Western Union has adopted zinc meta-arsenite as a standard treatment for yellow pine poles. It is a powder from which a solution is made at the treating plant by a representative of the manufacturer, who also supervises its injection into the wood, and insures that the wood is in proper condition for treatment. Its cost is slightly greater than that of zinc chloride and less than half that of creosote. It is said that this treatment can be carried on in any treating plant which is equipped for the Rueping process, using initial air pressure and final vacuum. It produces poles that are clean to handle and work upon and can be painted with ordinary paints, if desired. The poles are considerably lighter in weight than creosoted poles, due to evaporation of the water from the treating solution. Although the zinc meta-arsenite process has, so far, been applied only to the treatment of Southern yellow pine poles, plans are now being made to extend its application to other material, including bridge, building and car lumber.

This preservative is being promoted by the Curtin-Howe Corporation, 11 Park Place, New York, which company controls its use through patents.

A Portable Flare Light Unit

THE Oxweld Acetylene Company, New York, has become sole distributing agent for a new portable acetylene flare light manufactured by the American Carbolite Company, Inc., which is said to furnish a powerful light and to be of simple design. The unit, which has but three parts, is so constructed that it cannot be assembled incorrectly, and is equipped with a stormproof burner which it is said will function in violent gales.

The acetylene gas is produced from Carbic, a form of calcium carbide made into cakes of cylindrical shape and uniform size, which can be placed in the light in



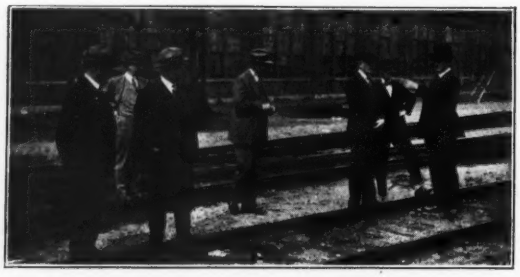
Night Work with the Carbic Flare Light

one charging in sufficient quantity to operate the flare continuously for 12 hours. In operation, an automatic feed permits the water to come in contact with the lowest cake of Carbic until sufficient acetylene has been generated to force the water out of the gas bell to a level below the bottom of the cake, this process being repeated continually during the operation of the light and providing uniform generation of gas. If the use of the light is discontinued before the entire charge of Carbic is consumed, the remaining portion may be left in the holder or can be removed and stored in the drum for later use, the method of operation insuring that the Carbic never rests on sludge, which settles to the bottom of the water, leaving the Carbic dry and clean. In case the light is upset, the water runs out of the container and the generation of gas ceases immediately.

This light is made in several styles, each entirely self-contained, ranging from the "Standard" model of 8,000 candlepower to a hand light. The "Standard" model weighs 36 lb. empty and 115 lb. charged, and has a height, with the reflector raised, of 6 ft. 7 in. A double burner model, furnishing light in two directions simultaneously, is available in about the same size as the "Standard" model.

On the Northern Pacific in Washington

With the Associations



The Bridge and Building Association

The proceedings of the last annual convention at Minneapolis have come from the press and are now being distributed to the members. Reports received from the chairmen of committees indicate that their work is well advanced.

The Roadmasters' Association

Approximately 25 officers and active members met at dinner at the Auditorium Hotel, Chicago, on Monday evening, March 5, to receive reports of the secretary and other officers and to consider the progress of the association. Tentative reports were also presented by the chairmen of various standing committees and suggestions made for their amplification and revision. These reports indicated that the work of the association is further advanced than at this time in any recent year.

The Wood-Preservers' Association

Ten members of the Executive committee met at the Palmer House on March 7 to plan the work of the association for the new year. After completing the committee personnel, consideration was given to the development of a "user's day" program for the Louisville convention next January, similar to that presented at Montreal. The committee adjourned to meet early in the summer jointly with the Committee on Wood Preservation of the A. R. E. A.

Maintenance of Way Club of Chicago

Problems confronting the electric line in maintaining crossings with steam railroads, where the electric line is the junior carrier and must pay all the charges, were the subject of a paper presented before the club on March 22, by Alf A. Oldfield. Mr. Oldfield was until recently engineer maintenance of way of the railway properties of the Wisconsin Power & Light Company and is now director of safety for the same company.

The Tie Producers' Association

The National Association of Railroad Tie Producers will hold its annual convention at the Hotel Arlington, Hot Springs, Ark., on April 24-26. Among those who will appear on the program are Earl Stimson, chief engineer of maintenance, Baltimore & Ohio, who will discuss "The Future of the Cross Tie Demand"; Nelson Courtland Brown, professor of forest utilization, New York State College of Forestry, Syracuse, N. Y., who will speak on "Failures of Substitute Cross Ties"; Evan W. Kelly, district forester, United States Department of Agriculture, who will treat on "Forests and Floods"; W. J. Smith, tie and timber agent of the Missouri-Kansas-Texas, who will discuss "Gum Ties," and Roscoe Hobbs, president of the Hobbs Tie & Timber Co., St. Louis, Mo., who will speak on "What the Tie Producer Expects of the Field Man."

Metropolitan Track Supervisors' Club

The next meeting of the Metropolitan Track Supervisors' Club will be held on Thursday, April 12, at 6 p. m., at the Hotel Martinque, New York City. At this meeting A. J. Neafie, principal assistant engineer of the Delaware, Lackawanna & Western, will give an informal illustrated talk on main line track construction and maintenance on the Lackawanna and the use that is being made of labor and time-saving equipment on that road.

American Railway Engineering Association

Although the annual convention closed as recently as March 8, the committees on Outline of Work and on Personnel have completed their assignments of members and of work for the committees and notices have already been sent those appointed. These appointments show many changes in personnel, including new chairmen for the committees on Ballast, Grade Crossings, Signals and Interlocking, Iron and Steel Structures and Shops and Locomotive Terminals.

A number of the committees have already organized for the year's work. The Roadway committee met in Chicago on March 27; the Committee on Economics of Railway Operation in Pittsburgh on March 28 and the committees on Iron and Steel Structures and on Grade Crossings at Chicago on March 30. The Committee on Economics of Railway Labor will meet in Chicago on April 4 and the Committee on Yards and Terminals at Richmond, Va., on April 23 and 24.

The subjects assigned to the various committees, together with the names of their chairmen, follow, with the subjects assigned for the first time shown in italics.

Roadway—Study the deformations of roadbed in the light of data developed by the Special Committee on Stresses in Railroad Track, with special reference to its effect on track maintenance; study improved methods for preventing corrosion of fence wire; study permanent roadbed construction, collaborating with the Committee on Track; *develop and report upon the conditions which should govern the use of culverts in construction and maintenance, and the factors which determine the most suitable type to be used, collaborating with the Committee on Masonry; develop and report upon drainage areas and water run-off, and the proper sizes of waterway openings required under the differing conditions in various parts of the country; prepare specifications for cast iron, for corrugated and other types of metal culverts; develop the best methods of preventing the formation of water pockets under the ballast when embankments are widened and/or raised.* C. W. Baldridge, assistant engineer, A. T. & S. F., Chicago.

Ballast—Review and report revisions, if necessary, on specifications for washed gravel ballast; study the comparative merits of ballast material, collaborating with the committees on Roadway and on Track; make a critical study of the cause and effect of pumping joints in railway track and the excess cost of maintenance resulting therefrom, with suitable recommendations for the removal of the cause, collaborating with the committees on Roadway and on Track; study the shrinkage of ballast, collaborating with the Committee on Track. E. I. Rogers, chief engineer, P. & P. U., Peoria, Ill.

Ties—Report on anti-splitting devices; continue investigations on the extent of adherence to the standard tie specifications; study and develop the best practice for switch tie renewals; study substitutes for wooden ties; study and develop the best practice for grading marks for ties to indicate acceptance; study and develop methods and rules for tie acceptance inspection; develop and recommend a traffic unit for use in comparing cross-tie life; study and report data on tie renewal averages per mile of maintained track; *report on definitions to cover the several species of wood included in standard specifications for cross-ties and switch ties;* make final report on the size of the hole for pre-boring. W. J. Burton, assistant valuation engineer, M. P., St. Louis, Mo.

Rail—Study details of mill practice and manufacture as they affect rail quality *and rail failures, giving special attention to*

transverse fissure failures, collaborating with the Rail Manufacturers' Technical committee; continue the compilation of statistics of all rail failures, making a special study of transverse fissure failures; continue the study of the cause and prevention of rail battering, collaborating with the Committee on Track; study the economic value of the different sizes of rail; study the reconditioning of battered or worn rail ends by the electric welding process, with especial reference to the effect upon the rail; study the drilling and spacing of holes in rails of all weights, and sizes of bolts for use with each weight; *consider the revision or the elimination of specifications for spring washers, collaborating with the Committee on Track; compile information of tests of alloy steel rails, addressing the various railroads for records of such tests as they may have made.* Earl Stimson, chief engineer maintenance, B. & O., Baltimore, Md.

Track—Continue a critical review of the material now appearing in publications of the association relating to curve elevation; ascertain existing views and practices of the railways and recommend such changes as are found desirable, *collaborating with the Committee on Rail;* study detailed plans of switches, frogs, crossings and slip switches; study track construction in paved streets; study and report on the design and specifications for foundations under railway crossings, also the proper methods for tie spacing and timbering under railway crossings; study and report on the methods of reducing rail wear on curves with particular reference to oiling the rail or wheel flanges, collaborating with the Committee on Rail; continue a critical review of material in the former proceedings with respect to the cause and effect of brine drippings, collaborating with the committees on Rail and on Iron and Steel Structures; *begin a study of the corrosion of rail and fastenings in tunnels, collaborating with the Committee on Rail.* J. V. Neubert, chief engineer maintenance of way, N. Y. C., New York.

Buildings—Study and report on specifications for concrete used in railway buildings, collaborating with the Committee on Masonry; study the rules and regulations for employees of the building department, collaborating with the Committee on Rules and Organization; study and report on the design and construction of water station buildings, collaborating with the Committee on Water Service; continue the preparation of specifications for buildings for railway purposes; *study and report on what constitutes appraisal on fire losses.* F. R. Judd, engineer of buildings, I. C., Chicago.

Wooden Bridges and Trestles—Continue the work on the simplification of grading rules and the classification of timber for railway uses, collaborating with other organizations dealing with this subject; study and report the advantage of establishing supply yards for standard trestle timbers at various locations throughout the country; study and report on the standardization and simplification of store stock and the disposition of material reaching obsolescence, collaborating with other committees and organizations concerned; *study and report on overhead wooden bridges.* W. E. Hawley, assistant engineer, D. M. & N., Duluth, Minn.

Masonry—Study the principles of design for plain and reinforced concrete for use in railway buildings, bridges and culverts, collaborating with the committees on Roadway, on Buildings and on Iron and Steel Structures; study and report upon the progress in the science of concrete manufacture; maintain contact with the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete and report to the association; study specifications for foundations, including excavation, cofferdams, piling, etc.; study and report upon general practices for waterproofing railway structures, collaborating with the committees on Buildings and on Iron and Steel Structures. C. P. Richardson, engineer track elevation, C. R. I. & P., Chicago.

Grade Crossings—Study methods for apportioning the cost of highway improvements adjacent to railway rights-of-way: (a) within incorporated limits of municipalities, and (b) without incorporated limits of municipalities; report on the comparative merits of various types of grade crossing protection, collaborating with the Committee on Signals and Interlocking; study excessive number of highway grade crossings of railways, with methods for their removal; study and report on the economic aspects of grade crossing protection in lieu of grade separation; report on the use of center columns for highway grade separations; report on various types and locations of approach and warning signs for grade crossings, also the practices in the several states and federal requirements, with a view to securing uniformity of practice and standards; study and report on (a) laws and regulations affecting the apportionment of federal aid; and (b) the proper form and character of division of costs of separation of grades as between the railway, state, county, municipal or other corporation; *evolve a formula which will develop and evaluate the relative benefits to the public and the railways from (a) grade crossing protection; (b) elimination of grade crossings; and (c) reduction of traffic on highway grade crossings.* F. J. Stimson, assistant chief engineer maintenance, Penna., Chicago.

Signals and Interlocking—Report on the developments of automatic train control, *collaborating with the Train Control committee, A. R. A.;* report on the developments of automatic highway crossing protection, collaborating with the Committee on Grade Crossings; prepare and submit as information a synopsis of the principal current activities of the Signal Section, A. R. A., supplemented with a list and reference by number of adopted specifications, designs and principles of signaling practice; *report on the increased efficiency secured in railway operation by signal indications in lieu of train orders and time table superiority, collaborating with the Committee on Economics of Railway Operation.* W. M. Post, assistant chief signal engineer, Penna., Philadelphia, Pa.

Records and Accounts—Collaborate with other committees in the preparation and design of forms pertinent to their work; report progress upon changes or revisions in the I. C. C. classification of accounts; study and report progressively upon methods and forms for gathering the necessary data for keeping up to date the physical and valuation records of the property of the railways *with respect to: (a) changes made necessary in government regulations; and (b) simplicity and practicability of use;* report upon methods and forms for handling the Interstate Commerce Commission's requirements under Order 15100—Depreciation Charges of Steam Railroad Companies; *study statistical requirements of the accounting, operating or other departments with respect to maintenance of way and structures, and recommend reports for maintenance foreman which as far as possible will reduce the number required and permit uniformity, simplicity and economy.* J. H. Hande, accounting engineer, B. & O., Baltimore, Md.

Rules and Organization—Study the subject-matter of each standing committee, distinguishing where necessary between rules and specifications, *abstracting therefrom such material as may be suitable for rules,* collaborating with standing committees concerned therewith; study and report on rules for the guidance of the employees of the maintenance of way department, with special reference to: (a) rules for employees who operate and maintain motor cars; (b) *rules for the maintenance of buildings;* (c) rules for the maintenance of bridges and (d) rules for the maintenance of other terminal structures; study the titles below the rank of division engineer, which are employed to designate positions of a corresponding rank in maintenance of way service, and make recommendations that will promote uniformity in nomenclature; *prepare rules for fire prevention as applying to railway property.* W. C. Barrett, trainmaster, L. V., Sayre, Pa.

Water Service—Study the causes and extent of pitting and corrosion of locomotive boiler tubes and sheets, giving consideration to quality of water, character of metals, methods of manufacture and types of boiler construction; study the relative cost of impurities in locomotive boiler water supply *and value of water treatment with respect to: (a) other methods of treatment where complete lime and soda ash treating is not justified; and (b) progress in water treatment on railroads and probable future development; study protective coatings for the interior of steel water tanks and underground pipe lines; study incrustation in pipe lines and methods for prevention, particularly where treated water is used;* study and make a final report on the use of gravity and pressure filters; *study fire protection and fire prevention at water stations, giving consideration to the type or character of fire protection appliances and power used, collaborating with the Committee on Rules and Organization;* study and make a final report on the design and maintenance of track pans for locomotive supply; study and make a final report on methods used for securing successful wells in fine sand formation; *study and report on railroad water columns, their advantages, if any, over tank spout delivery, range of operation, type of pit, and the relative merits of rigid and telescopic water spouts;* study progress being made by federal and state authorities on regulations pertaining to drinking water supplies; *study and report upon methods and practices of securing and handling water for drinking and culinary purposes by the railroads; study and report upon drinking water and coach yard sanitation, establishing contact with public health, medical and other bodies engaged in similar studies, collaborating with the Committee on Yards and Terminals.* C. R. Knowles, superintendent water service, I. C., Chicago.

Yards and Terminals—Study design and operation of passenger terminals *with particular reference to convenience and economy of operation of coach yards, collaborating with the*

committees on Shops and Locomotive Terminals, on Water Service and the Joint Committee on Railway Sanitation; collaborate with the Committee on Uniform General Contract Forms on forms of agreement for joint ownership, use and management of a terminal project, giving special consideration to fundamental requirements; study the design and operation of freight terminals *with particular reference to car-to-car transfer of through l.c.l. freight, collaborating with the Committee on Economics of Railway Operation;* study the proper requirements for a practical design and construction of humps in terminal yards, collaborating with the Committee on Economics of Railway Operation; *prepare a summary of the essential principles to be considered in the design of modern freight terminals;* continue the study of and specifications for various types of scales used in railway service; *study and report on weight control of railway test weight cars.* J. E. Armstrong, assistant engineer, C. P. R., Montreal, Que.

Iron and Steel Structures—Make a final report upon proposed specifications for steel highway bridges; report upon the feasibility of the electric welding of connections in steel structures; undertake the testing and study the behavior of bridge pins under test loads; *report on tests of I-beams in groups;* undertake the testing and study the behavior of steel columns under test loads; investigate the desirability of using copper-bearing steel for structural purposes; study the influence of the dead load upon the impact from moving loads on bridges; *make a final report on bearing pressures on large rollers.* A. R. Wilson, engineer of bridges, Penna., Philadelphia, Pa.

Economics of Railway Location—Study economics of grade revision as affected by the introduction of electric locomotives, collaborating with the Committee on Electricity; study the relative merits of ruling grades lighter than 0.4 per cent, *in the light of modern operating requirements;* study the relative merits of increasing tonnage by the reduction of ruling grades or by the introduction of locomotives with greater tractive power, with consideration of momentum grades and the development of the locomotive booster; study locomotive capacity, giving special attention to oil-burning locomotives, collaborating with the appropriate committee of the Mechanical Division, A. R. A.; *prepare in a form for convenient use, the essential operating data required for making relative comparisons of values for studies of line and grade revisions to meet modern operating requirements; study and report on the extent train resistance is increased when trains are operating on flexible rails as compared with the same operation with stiffer rails, collaborating with the committees on Rail and on Economics of Railway Operation.* F. R. Layng, assistant chief engineer, B. & L. E., Greenville, Pa.

Wood Preservation—Report on definitions used in wood preservation; study and report upon service test records of treated ties; study, investigate and report on piling used for marine construction; study and report upon the effect of preservative treatment by the use of: (a) creosote and petroleum and (b) zinc-chloride and petroleum; *prepare specifications for treatment of air-seasoned Douglas fir.* F. C. Shepherd, consulting engineer, B. & M., Boston, Mass.

Electricity—Continue the subject of inductive co-ordination, as well as representation with the American Committee on Inductive Co-ordination; study the tidal water power development on Passamaquoddy bay and on the St. Lawrence river, when actual construction is in progress, *also report on the Alabama power development on the Tennessee river and present information as to the extent that water power is used for railroad operation at the present time;* continue representation on the American Committee on Electrolysis; continue collaboration with the U. S. Bureau of Standards in the revision of the National Electrical Safety Code and other codes of a similar character; continue the study of electric light, power supply and trolley lines crossing railways, with a view to keeping the association informed with regard to changes which may be desirable in the specifications; continue the state representatives and their alternates; revise and keep up to date the transmission line and catenary specification; study economics of railway location as affected by electric operation, collaborating with the Committee on Economics of Railway Location; study insulating tapes, *with especial reference to cambric and paper tapes;* study insulators, with a view of keeping up to date the specifications previously adopted; *continue the subject of clearances of overhead conductors with a view of harmonizing discrepancies which now exist in the various specifications, collaborating with the Special Committee on Clearances and other commitees as may be necessary;* study protection of oil sidings from danger due to stray currents, with a view to keeping up to date rules previously adopted; study track and third rail bonds, with especial reference to: (*a*) *study details of bond design with a view to developing specifications covering the different classes of bonds;* (*b*) *collect information as to methods and extent of practice in re-applying bonds;* (*c*) *collect data on composition used, if any, on rail joints to replace bonds;* (*d*) *study contact areas and resistances for different types of bonds;* and (*e*) *compile information concerning rail joint clearance and its effect on rail bond design;* continue the revision and keep up to date the incandescent lamp schedule; study flood lighting for classification yards and for other railroad purposes, collaborating with the Committee on Yards and Terminals; study design of indoor and outdoor substations; *investigate cables for carrying high voltages.* Edwin B. Katte, chief engineer, Electric Traction, N. Y. C., New York.

Uniform General Contract Forms—Study form of agreement for joint ownership, use and management of a terminal project, collaborating with the Committee on Yards and Terminals; study form of cost-plus percentage and *fixed fee in construction contracts; form of agreement for the purchase of electrical energy in a large volume (such as required for traction purposes), collaborating with the Committee on Electricity; form of application for industry track;* continue the study of form of agreement for use of railway property for public highways. J. C. Irwin, valuation engineer, B. & A., Boston, Mass.

Economics of Railway Operation—Study the methods for obtaining a more intensive use of existing railway facilities, with particular reference to increasing carrying capacity: (a) without material additional capital expenditures; and (b) with due regard to reasonable increases in capital expenditures consistent with traffic requirements; study the methods and formulas for the solution of special problems relating to more economical and efficient railway operation; study the most economical makeup of track to carry various traffic densities, *collaborating with the Committee on Rail;* study suitable units for operating and equipment statistics required by the Interstate Commerce Commission, to be used on cost comparisons of transportation, equipment and roadway maintenance, with the necessary additions thereto, collaborating with the committees on Records and Accounts and on Economics of Railway Labor; study what volume or other conditions of business or service justifies a change from flat switching to the hump method in any given yard, collaborating with the Committee on Yards and Terminals; study the problems of railway operation as affected by the introduction of motor trucks and bus lines, with particular reference to its effect upon branch or feeder lines, collaborating with the Motor Transport Division, A. R. A.; *study and develop methods for the most economical train length, considering all factors entering into transportation costs, such as fuel, road time, length of passing sidings, per diem, etc.; study the economy resulting from the use of radio telephones for long freight trains and for yard work.* J. M. Farrin, special engineer, I. C., Chicago.

Economics of Railway Labor—Study the methods for securing greater efficiency and economy by the use of labor-saving devices in railway track maintenance, *including devices that will operate off the track;* study standardization of parts and accessories for railway maintenance motor cars; study the equating of track values for labor distribution; *economic ratio of supervision to labor; study the best means for the practical education and training of the individual workman in his assigned duties as a means of securing an increased output of better quality with less effort and fewer accidents.* A. N. Reece, chief engineer, K. C. S., Kansas City, Mo.

Committee on Shops and Locomotive Terminals—Study design for: (a) *coal and sand plants;* (b) typical locomotive repair shops; and (c) shops and locomotive terminals with particular reference to convenience and economy of operation, collaborating with the Committee on Buildings and with the Mechanical Division, A. R. A. A. T. Hawk, engineer of buildings, C. R. I. & P., Chicago.

Co-operative Relations with Universities—A greater interest upon the part of railroad officers in assisting the universities to develop the best possible methods for the technical courses; a better means of bringing to the universities the results of the association's deliberations, where such can be made of value to them; a better means of bringing to the attention of the railroads the benefits of a technical education, thereby acquainting them with the qualifications of graduates of these courses for initial service in subordinate positions, and at the same time providing material from which men may be drawn for higher positions as they demonstrate their fitness; a means whereby the facilities of the universities may be made more directly available for the research work of the association by co-operative effort between their laboratories and the committees of the association; a means whereby the universities may be better enabled to educate the students and the public regarding the value of transportation to the nation as a whole; a means of stimulating a greater interest among university officials in the study of transportation and economics and impressing them

with the importance of experienced men for such teaching. Robert H. Ford, assistant chief engineer, C. R. I. & P., Chicago.

Special Committee on Stresses in Railroad Track—Continue the study of stresses in railroad track. A. N. Talbot, professor of municipal and sanitary engineering and in charge of theoretical and applied mechanics, University of Illinois, Urbana, Ill.

Special Committee on Standardization—W. C. Cushing, engineer of standards, Penna., Philadelphia, Pa.

Special Committee on Clearance—Study and report on a general clearance diagram, bridge clearance diagrams, tunnels, and third rail. A. R. Wilson, engineer bridges and buildings, Penna., Philadelphia, Pa.

Special Committee on Rivers and Harbors—Report upon methods for providing against river bank erosion; determine the best types of construction for levees and river dikes for flood protection, giving recommended dimensions; determine the proper allowance for swell in scow measurement dredge work; determine the proper amount of allowable overdepth in dredging operations to obtain the desired operating depth; determine the average deposit in fresh water rivers bearing silt and in brackish waters within the tidal range; prescribe the best approved method of taking soundings in river waters, in tidal waters, with both hard and soft bottoms; ascertain the usual slope taken in deep waterways for quiet waters and for those affected by wave action; determine the effect of slight salinity on deposit of silt in rivers and slips; study the result of deepening channels on the salinity of rivers and estuaries. Col. Wm. G. Atwood, consulting engineer, New York.

The Material Market

WHILE structural steel is not the most important item of material in the railway maintenance field, it represents such a large factor in the general market for steel that it serves as a fair index of market trends. Therefore, the most significant event in the steel market during the past month was an advance of $1 per ton on structural steel, effective March 1. This raised the prices at Pittsburgh and Chicago to 1.90 and 2.00 cents per pound, respectively, with a premium of $2 per ton or 0.10 cents per lb. for purchases in lots of less than 100 tons. As usual, the announcement was followed by similar action on the part of other manufacturers with corresponding adjustments for other basing points.

This was the third formal advance in prices of structural steel since November 10, 1927, and is no doubt a significant answer to prevailing reports to the effect that the price advance of January 19 had not been thoroughly established owing to the current practice of permitting buyers with open contracts to increase their tonnages at the lower rates. In this same way, it is apparent that the new quotations are not universally adhered to, particularly with respect to higher rates for small orders. The market is stronger in the Middle West than it is east of Cleveland. Thus, at Chicago the new price of 2 cents appears to be the going rate, while in the Pittsburgh-Youngstown district a considerable volume of orders is still being placed at 1.85 cents or even 1.80 cents instead of 1.90 cents. This is an obvious reflection of the relatively greater industrial activity in the Chicago area. Thus, steel production in that district is rated at 95 per cent of capacity as compared with 80 per cent in the Pittsburgh-Youngstown area.

Changes in quotations on other items include an advance of $3 per ton on cast iron pipe and 15 cents per 100 lb. for rivets, and a reduction of 10 cents per 100 lb. on steel tie plates. Prices of other track materials have not changed. Prices of wire and wire products have been irregular and are weak in the East but fairly stable in the Middle West.

Estimates of the total volume of rail orders placed during the past winter indicate a tonnage fully equal to that of the previous season of rail buying. Orders for track fastenings are estimated at 20 per cent over those of a year ago. Although the season of rail buying is over, scattering orders were placed during the past month, among which the largest were those of the Rock Island (50,000 tons), the Great Northern (30,000 tons), and the Western Pacific (10,000 tons). It is estimated that orders for rail now in hand will keep the mills busy until the middle of June. The market for track accessories is showing greater activity but the individual orders are of moderate size.

The scrap market is somewhat weak and prices are lower than those quoted for February.

Orders for southern pine and Douglas fir placed since the first of the year aggregate appreciably in excess of those for the same period in 1927. Production and shipments are also larger. However, while orders and shipments exceed production in the southern pine field, reports from the West Coast Lumbermen's Association indicate a rate of production moderately in excess of both sales and deliveries. The general tone of the lumber market is quiet and prices have been subject to but little change.

Portland cement prices show their well known stability. Except for a reduction of 1 cent in the quotation at Cincinnati, the prices in the table below are the same as those appearing in last month's issue. These prices are per barrel in carload lots, not including package.

New York	$2.03	Minneapolis	$2.22
Pittsburgh	2.04	Denver	2.85
New Orleans	2.07	Dallas	2.05
Chicago	2.05	San Francisco	2.41
Cincinnati	2.22	Montreal	1.41

Iron and Steel Prices Per 100 Lb.

	February				March			
	Pittsburgh		Chicago		Pittsburgh		Chicago	
Track spikes	$2.70 to	$2.80	.....	$2.80	$2.70 to	$2.80	.....	$2.80
Track bolts	3.80 to	4.00	.....	3.80	.....	3.80	.....	3.80
Angle bars	.....	2.75	.....	2.75	.....	2.75	.....	2.75
Tie plates, steel	.....	2.25	.....	2.25	.....	2.15	.....	2.15
Boat spikes	2.90 to	3.00	2.90 to	3.00	2.90 to	3.00	2.90 to	3.00
Plain wire	.....	2.50	.....	2.55	.....	2.50	.....	2.55
Wire nails, keg	.....	2.65	.....	2.70	.....	2.65	.....	2.65
Barb wire, galv.	.....	3.35	.....	3.40	.....	3.35	.....	3.40
C. I. pipe, 6 in. to 12 in., ton	.....	.....	34.20 to	36.20	.....	.....	36.20 to	39.20
Plates	.....	1.85	1.95 to	2.05	1.85 to	1.90	.....	2.00
Shapes	.....	1.85	1.95 to	2.05	1.85 to	1.90	.....	2.00
Bars, soft steel	.....	1.85	1.95 to	2.05	1.85 to	1.90	.....	2.00
Rivets, struc.	.....	2.75	.....	2.85	.....	2.90	.....	3.00
Con. bars, billet	1.90 to	1.95	.....	.....	1.90 to	2.00	.....	.....
Con. bars, rail	.....	1.75	.....	1.80	.....	1.75	1.80 to	1.85
Rails per gross ton f.o.b. mills	.....	.....	.....	43.00	.....	.....	.....	43.00

Scrap Prices Per Gross Ton at Chicago

	February	March
Relaying rail (including angle bars)	$26.00 to $31.00	$26.00 to $31.00
Rails for rerolling	15.00 to 15.50	14.50 to 15.00
Rails less than 3 ft. long	15.25 to 15.75	15.00 to 15.50
Frogs and switches cut apart	14.25 to 14.75	13.50 to 14.00
Steel angle bars	14.00 to 14.50	14.00 to 14.50

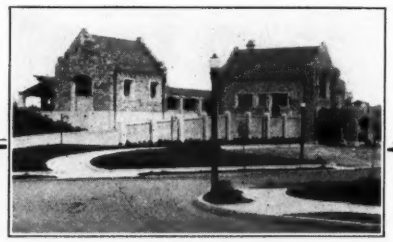
Southern Pine Mill Prices

	February	March
Flooring, 1x4, B and btr., flat	$37.75	$38.00
Boards, 1x8, No. 1	33.25	32.15
Dimension, 2x4, 16, No. 1, common	24.70	24.00
Dimension, 2x10, 16, No. 1, common	25.83	26.75
Dimension, 2x4, 16, No. 2, common	22.81	22.63
Dimension, 2x10, 16, No. 2, common	20.60	21.16

Douglas Fir Mill Prices

	February	March
Flooring, 1x4, B. and btr., flat	$23.50	$24.50
Boards, 1x8, No. 1	15.75	15.75
Dimension, 2x4, 16, No. 1, common	17.50	17.50
Dimension, 2x10, 16, No. 1, common	17.75	17.25
Dimension, 3x3 to 4x12, No. 1, common	18.75	18.75
Dimension, 5x5 to 12x12, No. 1, common rough	17.00	17.00

Railway News



Briefly Told

The track department of the Northern division of the Kansas City Southern won the system safety banner during 1927 with a record of 608,997 man-hours per reportable injury, with 8 out of 18 units exceeding the goal of 100,000 man-hours per injury set for the year.

The bridge and building department of the El Paso division of the Southern Pacific went through 1927 without a reportable injury. Ten gangs were employed, with man-hours for each gang for the year ranging from 16,709 to 49,685, the total man-hours for the 10 gangs aggregating 273,768.

Revenue freight car loadings for the week ending March 17 totaled 942,086, a decrease of 54,775 cars as compared with the same week in 1927 and of 34,932 as compared with 1926. The cumulative total for the first 11 weeks of the current year was 9,890,593, as compared with 10,577,145 and 10,273,480 in the corresponding periods in 1927 and 1926 respectively.

The Southern has announced that it will transfer to Atlanta, Ga., about 1,200, or more than one-half, of the employees now located at its general offices at Washington, D. C., and that the Washington offices will be moved to a new building at Fifteenth and K streets. The government has authorized the purchase of the site of the present office building in connection with an extensive public buildings program.

The Harvard Award for Distinguished Services to Advertising (1927), commonly known as the "Bok Award," has been presented to James H. McGraw, president of the McGraw-Hill Publishing Company, publishers of business and technical journals. The award, which is made annually by a jury appointed by the dean of the Harvard Graduate School of Business Administration, consists of a gold medal containing the inscription: "For distinguished personal service rendered American commerce and industry through raising the standards of advertising."

Iceland may lose its distinction as the only European country larger than a municipality which has no railway, as the result of a concession granted last year to a Norwegian concern which authorizes a 160,000-hp. hydro-electric development and also a railway from the port of Reykjavik, a city of 22,000 inhabitants, easterly 41 miles to the fertile agricultural district in the Southwestern lowlands. The country through which the road will pass is barren and hilly and is at present crossed by an unsatisfactory automobile road which is often made entirely impossible by winter snows.

H. A. Rowe, chairman of the committee of the safety section, A. R. A., which deals with the campaign against accidents at grade crossings, has issued a circular calling attention to the fact that for the first 11 months of 1927 the Interstate Commerce Commission reports 124 fewer deaths and 445 fewer injuries at crossings than in the preceding year, in spite of an increase of about 2,000,000 automobiles. The circular suggests an early re-inspection of all grade crossings, the removal of objects that obstruct the wayfarer's view and attention to other well-known precautions.

In order to stimulate competition among employees of the different regions of the Pennsylvania in avoiding accidents, President W. W. Atterbury has announced that five trophies will be awarded to the departments which make the best record in this respect in each region during 1928. The trophies will be awarded quarterly to the winning departments for temporary custody. The management hopes to reduce the injuries in 1928 to not more than 10 per million man-hours worked, a figure which is one-third less than heretofore on that road and 50 per cent less than the record of all Class I roads in the country in 1927.

A. A. Lazarevsky, chief engineer of the Russian state railways, together with three of his engineers, recently completed a 10-days' tour of observation and inspection over the Northern Pacific as guests of Col. B. O. Johnson, assistant to the president of that road. Mr. Lazarevsky is about to begin the construtcion of 1,000 miles of new lines and came to America to study the methods of construction employed here. Colonel Johnson and Mr. Lazarevsky became acquainted while the former was spending five years in Russia, from 1917 to 1923, as vice-chairman of the Inter-Alied Technical Board, engaged in maintaining operation of the Trans-Siberian Railway.

Opposition to bills now under consideration in Congress for restricting immigration from Mexico by the application of the quota system was voiced by Alfred P. Thom, general counsel of the Association of Railway Executives at hearings before the committees on immigration of the House and Senate on February 28 and 29. Mr. Thom pointed out that in the southwestern part of the United States both the railroads and agriculture have become adjusted to the employment of a large proportion of Mexican labor and that to disrupt this condition would have serious results by tending to create a labor shortage under which these industries would be bidding against each other for the available supply.

A delegation of railway officers called on President Coolidge at the White House on February 27 to explain their position that the cost of roadway and other physical changes on the railways to conform to the plan of the government engineers for flood control on the Mississippi river should be borne, at least in part, by the government. A committee of railway engineers presented before the house committee on January 25 and 26 a report estimating that the changes required to conform to the plan proposed by General Jadwin, chief of engineers, would entail a total cost of $71,835,000 to 11 railways in the area in which the work would be done. The delegation consisted of Alfred P. Thom, general counsel of the Association of Railroad Executives, L. A. Downs, president of the Illinois Central, L. W. Baldwin, president of the Missouri Pacific, A. D. McDonald, vice-president of the Southern Pacific, and R. E. Milling, general attorney of the Louisiana Railway & Navigation Company.

The effort of the Brotherhood of Sleeping Car Porters to have tipping abolished as part of a campaign for higher wages has received a set-back from the Interstate Commerce Commission to whom complaint had been made by the brotherhood that practices of the Pullman Company in relation to tipping constituted a violation of the Interstate Commerce Act. The Pullman Company filed a motion to dismiss for want of jurisdiction and, after argument before the full commission, the motion to dismiss was sustained, the report stating that a consideration of the complaint led only to the conclusion that the real objective was an increase in wages and that the commission has no power to regulate wages. According to A. P. Randolph, general organizer of the brotherhood, a strike vote will be taken within the next few weeks as a result of the commission's ruling.

Construction News

The Baltimore & Ohio has let a contract to the Vang Construction Company, Cumberland, Md., for the grading of yard tracks at Maplewood, Ohio, at a cost of $30,000.

The Beaver, Meade & Englewood plans the construction of an extension from Hooker, Okla., to Des Moines, N. M. Location surveys and estimates have been completed for the construction of the first section of the proposed extension from Hooker to the New Mexico state line, 97 miles. The cost of this section is estimated at $20,240 per mile.

The Canadian Pacific has announced plans for new construction on the Western lines in Manitoba, Saskatchewan, Alberta and British Columbia in 1928, including the building of coaling stations at Elkhorn, Man., Hardisty, Alta, and Vulcan, at Wilkie, Sask., and Goudie, and at Crows Nest, B. C., Nelson and Tadance. It is planned to rebuild the enginehouse at Nelson, and construct a new power house at Brandon, Man. The capacity of the freight car shops at Weston, near Winnipeg, Man., will be doubled by the construction of a concrete, brick and steel addition, having outside dimensions of 305 ft. by 315 ft., and the locomotive shops at the same point will also be enlarged. Combined freight and passenger stations will be constructed at McMahon, Sask., Armley, Sylvania, Lac Vert, Neilburg, Crane Valley, Tuberose, Rockglen, Coronach, Fox Valley and Carmichael, Queenstown, Alta, and Hobbema. Grade revisions will be undertaken on the main line between Brandon, Man., and Sidney.

The Chicago & North Western closed bids on March 9 for the construction of a concrete block and tile passenger station 22 ft. by 88 ft., at Carrollville, Wis. A contract for the construction of a freight station at Appleton, Wis., has been let to E. A. Johnson, Chicago, at a cost of about $55,000.

The Chicago, Burlington & Quincy has awarded contracts to the Roberts & Schaefer Company, Chicago, for the construction of a four-track automatic electric fireproof coaling station of 400-tons capacity at the Western Avenue terminal, Chicago, and for the construction of a 50-ton automatic electric shallow pit type locomotive coal handling plant and an N. & W. type single track cinder handling plant at 14th street, Chicago.

The Chicago, Rock Island & Pacific has begun the construction of an addition to the Armourdale yard at Kansas City, Mo., which is expected to involve an expenditure of about $100,000.

The board of directors has approved plans for the immediate construction of an extension of the Amarillo-Stinnett branch from Stinnett, Tex., to Gruver, 34 miles. The terminus of this line will be 91 miles from Amarillo, Tex., and will provide transportation for a section which produces oil and wheat.

The Denver & Rio Grande Western is accepting bids for the construction of five water treating plants in Utah as follows: Cisco, 15,000 gal. of treated water per hour; Helper, 30,000 gal. per hour; Farnham, 15,000 gal. per hour; Westwater, 15,000 gal. per hour; and Green River, 30,000 gal. per hour.

The Galveston, Houston & Henderson has asked the Director of the Port of Houston (Tex.) for permission to reconstruct its bridge over Buffalo bayou at Allen street, Houston, replacing a swing span with a fixed span having a 40-ft. vertical clearance above the water level.

The Grand Trunk Western's application for authority to construct a belt line 6.63 miles long around a part of the city of Pontiac, Mich., has been reported on favorably by an examiner of the Interstate Commerce Commission who has recommended that a certificate be issued authorizing the construction. The same report recommended that the application of the Pere Marquette for authority to build a line from Wixom, Mich., to Pontiac, together with a belt line around the latter city, be denied.

The Interstate Commerce Commission has authorized the Detroit, Grand Haven & Milwaukee (a Grand Trunk subsidiary) to construct a line of railroad from Royal Oak to Bloomfield, a distance of 8.88 miles, all in Oakland County, Michigan, and authorized the abandonment by the applicant of that part of its existing line between the points mentioned, a distance, along the present route, of 9.1 miles, also wholly within Oakland County. The cost of the entire project is estimated at $3,071,350.

The Long Island is considering plans for the establishment and construction of a new station at DuBois avenue, between Valley Stream, N. Y., and Hewlett.

The Louisville & Jeffersonville Bridge & Railroad Company has awarded a contract for the reconstruction of the steel superstructure of the bridge over the Ohio river between Louisville, Ky., and Jeffersonville, Ind., to the McClintic-Marshall Company, Pittsburgh, Pa. A contract has been let to the Walsh Construction Company, Davenport, Iowa, for the concrete and masonry work in connection with the rebuilding of the bridge and its approaches. The total cost of the project is estimated at $3,250,000.

The Manufacturers' Railway has applied to the Interstate Commerce Commission for authority to build four lines aggregating about 4.5 miles at St. Louis, Mo., connecting its track with those of the St. Louis Transfer and the St. Louis Municipal Bridge. This would also afford a connection between the Manufacturers' and the St. Louis & O'Fallon, which is controlled by the same interests and which is connected with the bridge on the Illinois side of the Mississippi river.

The Michigan Limestone Chemical Company has awarded a contract to the Roberts & Schaefer Company for the construction of a 150-ton automatic locomotive coal handling plant at Rogers City, Mich.

The Missouri Pacific has awarded a contract for the construction of the substructure of the Baring Cross bridge over the Arkansas river at Little Rock, Ark., to the Missouri Valley Bridge & Iron Company, Leavenworth, Kans., at a cost of about $275,000.

The New York Central has let a contract to James Stewart & Co., Inc., of New York, for alterations of the present structure, construction of overhead roadways along the westerly side of Grand Central terminal and the terminal office building, and over the 45th street viaduct extending to the north building line of 45th street, Grand Central terminal, in New York.

An agreement has been reached with the officials of the City of Toledo, Ohio, for the elimination of a grade crossing at Central Avenue, by the elevation of the railroad tracks at that point and the construction of a steel and concrete structure which will span a 54-ft. highway roadway and two 12-ft. sidewalks.

The Nicholas, Fayette & Greenbrier, organized in the interest of the New York Central and the Chesapeake & Ohio, has applied to the Interstate Commerce Commission for authority to build a line from Swiss, W. Va., to Nallen, 29 miles, to reach timber and coal deposits.

The Northern Pacific has let a contract for the construction of a four-track reinforced concrete bridge over Walnut street, Yakima, Wash., to E. J. Dunnigan, St. Paul, Minn. The cost of this project, which includes raising about one mile of track and depressing the street, is estimated at $250,000.

The Panhandle & Santa Fe is preparing plans for the construction of a 12-story concrete, brick and steel office building at Amarillo, Tex. Outside dimensions of the building will be 90 ft. by 140 ft.

The Pecos & Northern Texas has applied to the Interstate Commerce Commission for authority to build an extension from Hale Center, Tex., to Parmerton, 66 miles.

The Pennsylvania has presented to the city authorities of Baltimore, Md., a tentative preliminary plan for the improvement of its main line between New York and Washington through that city. The proposed improvements include the construction of third and fourth tracks to a point west of the city, additions to the passenger station facilities and the elimination of a number of highway grade crossings with proposals for the eventual electrification of this part of the line, most of which will be in tunnels. The estimated cost of the improvements as

planned is $15,000,000, not including the cost of electrification.

Under an agreement with the Wabash and the owners of four produce companies this company will construct a union produce terminal at Fort Wayne, Ind., at a cost of about $350,000. The terminal proper will be made up of four two-story brick and concrete buildings, three of which will have outside dimensions of 50 ft. by 125 ft. and the fourth, dimensions of 60 ft. by 125 ft.

The Pittsburgh, Lisbon & Western, control of which has been sought by the Montour Railroad, a Pennsylvania corporation, has applied to the Interstate Commerce Commission for authority to construct 27 miles of line from Milrock into Youngstown, Ohio, with a four-mile branch to Struthers' near Youngstown. It has also applied for permission to build an additional 13 miles from Negley, Ohio, to Smiths Ferry, a point on the Ohio river in Pennsylvania.

The St. Louis, Brownsville & Mexico has applied to the Railroad Commission of Texas for permission to construct a line between Algoa, Tex., and Dickinson, 9 miles, to form a direct connection between Galveston, Tex., and Brownsville. In the same application the railroad asked permission to construct a line from a point between Brazoria, Tex., and Allenhurst on the Houston-Brownsville line to a point 25 miles northwest thereof.

The St. Louis-San Francisco will contribute about $300,000 to the total cost of a viaduct at Arsenal street, St. Louis, Mo., which will cross the River des Peres as well as the Frisco tracks and which will involve a total expenditure of $531,000. The Board of Public Service of St. Louis has awarded a contract to Joseph Kesl & Son, Edwardsville, Ill., for the construction of the viaduct at a cost of about $365,000.

The Sacramento Northern has applied to the Interstate Commerce Commission for a certificate authorizing the construction of a line connecting its Suisun branch with the line of the Petaluma & Santa Rosa at Petaluma, Cal., 36.2 miles, for the purpose of giving the Western Pacific, through the Sacramento Northern, access to territory served by the Petaluma & Santa Rosa, which it is seeking authority to acquire.

The Southern Pacific has awarded a contract for the relocation of 19 miles of line on the branch between Bowie, Ariz., and Globe, to the Utah Construction Company, San Francisco, Cal. This contract, which involves an expenditure of about $2,400,000, covers the grading, construction of new track and bridges and relocation of stations.

The Waco, Beaumont, Trinity & Sabine has started the construction of extensions from Weldon, Tex., to Waco, and from Livingston, Tex., to Port Arthur, with company forces. It is intended that company forces will be employed on this project only until such time as a general contract is let.

Supply Trade News

General

The Hopkins-Benedict Company, Chicago, has been appointed sales representatives of the Anchor Company, Milwaukee, Wis.

The Inland Steel Company and the **Youngstown Sheet & Tube Company** have abandoned the proposed merger of the two companies, following their inability to agree on certain features regarding the consolidation.

The Worthington Pump & Machinery Corporation will move its executive offices and its export and New York district sales departments from 115 Broadway to 2 Park avenue, New York, about April 1. The general sales office and the advertising department have been moved to its plant at 421 Worthington avenue, Harrison, N. J.

The Oxweld Acetylene Company, New York, will in the future be exclusive distributors of the Carbic acetylene floodlight, the carbic acetylene generator and other equipment formerly sold by the Carbic Manufacturing Company, Duluth, Minn. The processed carbide in cake form, known under the trade name of Carbic, for the Carbic lights and generators, will be distributed exclusively by the Union Carbide Sales Company, of New York City.

The Sperry Rail Service Corporation, Brooklyn, N. Y., has been organized to extend to railroads the service of its detector cars for inspecting rails in tracks for the purpose of locating and recording interior defects such as transverse fissures. Equipment for recording the physical conditions of track will also be a feature of this service. As announced in the March issue, **Charles W. Gennet, Jr.,** has been elected vice-president, with headquarters in the Railway Exchange building, Chicago, and is in charge of all operations.

Personal

H. M. Davidson, general manager of sales of the Hayward Company, New York, has resigned.

J. B. Drillette, general superintendent of the Louisville Frog & Switch Company, Louisville, Ky., has been elected vice-president of that company.

H. S. La Barge, manager of railway sales of the Glidden Company, Cleveland, Ohio, with headquarters at Cleveland, has been transferred to St. Louis, Mo.

P. P. Barrett has been appointed representative of the Reading Iron Company, Reading, Pa., in the Cincinnati territory, with headquarters in Indianapolis, Ind.

N. Morton Skillen has been placed in charge of the Boston, Mass., office of the Cohoes Rolling Mill Company, Cohoes, N. Y., succeeding **P. L. Watkins,** who was transferred to Chicago.

Frank K. Tutt, special representative of the Bird-Archer Company, New York, with headquarters at St. Louis, Mo., has been promoted to district manager, with headquarters at the same point. A sketch of Mr. Tutt's career was published in the December issue of *Railway Engineering and Maintenance.*

Albert J. Davis, general superintendent of the Ellington-Miller Company, Chicago, has been promoted to general manager. Mr. Davis, previous to his connection with the Ellington Miller Company, had been an estimator for the Belledeu Company, Boston, Mass., as well as construction superintendent for the Wells Brothers Company, New York, and the George B. Swift Company, Chicago. He served as an officer in the engineering corps during the World War, being awarded the Distinguished Service Medal and the Italian War Cross.

E. M. Converse, manager of the specialty department of the Dearborn Chemical Company, Chicago, has been promoted to sales manager of the company, the specialty department and the stationary departments having been merged. W. A. Converse, secretary and chemical director, who has been director of sales of the stationary department, will now devote more of his time to matters of general operation.

E. M. Converse was educated in chemistry at Armour Institute and Northwestern University and entered the service of the Dearborn Chemical Company in 1902 as a laboratory assistant. He was placed in charge of inspection of materials in 1906 and from 1908 to 1918 was on the road as a salesman and service man. He was then promoted to manager of the specialty department, which position he was holding at the time of his recent promotion to sales manager.

E. M. Converse

C. I. Auten, manager of the steel building department of the Truscon Steel Company, Youngstown, Ohio, has been elected vice-president in charge of sales in the Standard Building division and will have jurisdiction

over the sales of structural steel, steel-deck roofing and transmission structures. **M. T. Clark,** manager of the Sash department, has been elected vice-president in charge of sales of the Steel Window division and **C. D. Loveland,** manager of the Pittsburgh district, has been elected vice-president in charge of distribution in New Jersey, with headquarters at Newark, N. J.

Roy A. Phelps, assistant to the manager of the railway sales department of E. I. Du Pont de Nemours & Co., Inc., has been promoted to district manager of the railway sales department, with headquarters at Parlin, N. J., to handle the company's business in the southeastern territory. **Carl F. Gehlen** has been appointed assistant to the manager of the railway sales department, with headquarters at Parlin, to succeed Mr. Phelps.

Mr. Phelps was born on October 22, 1895, at Chicago. After completing his education at Dayton, Ohio, he entered the service of the Dayton Tire & Rubber Co., with which concern he remained until 1917, when he entered the United States Army. On his return to civil life in May, 1919, he became connected with the sales department of the Sherwin-Williams Company, handling sales for the railway, marine and petroleum division. On January 1, 1926, Mr. Phelps was appointed assistant to the manager of the railway sales department of E. I. Du Pont de Nemours & Co., Inc., which position he was holding at the time of his recent promotion to district manager of sales of that department.

Carl F. Gehlen

Mr. Gehlen was born on July 14, 1897, at New York, and entered New York University in 1915 for a course in mechanical engineering. He left school to enter the United States Army in September, 1918, and after his discharge from military duties in 1919 became a testing engineer for the Milwaukee Electric Railway & Light Co. Later he was engaged in industrial appraisals and in 1924 became assistant sales manager of the Ingersoll Rediopoint Company, with headquarters at St. Paul. He entered the service of the Du Pont Company in September, 1925, and about a year later became associated with L. O. Cameron, railway supplies, at Washington, D. C., where he was located at the time of his recent appointment as assistant to the manager of the railway sales department of the Du Pont Company.

P. A. Orton, Jr., in charge of sales in the Chicago territory for the Orton Crane & Shovel Company, Chicago, has been elected vice-president and sales manager, succeeding, in the latter capacity, **Herbert Mertz,** secretary and sales manager, who has been elected vice-president in charge of sales in the New York territory. **Alex Orton,** works manager at Huntington, Ind., **C. C. Case,** Chicago, and **J. L. Kenower,** Huntington, have been elected directors.

P. A. Orton, Jr.

P. A. Orton, Jr., after graduating from Purdue University in 1923, entered the employ of the Orton Company in the shop and drafting depart-

Herbert Mertz

ments, and later was placed in charge of sales in the Chicago territory, which position he was holding at the time of his recent election as vice-president and sales manager.

Mr. Mertz was born at Chicago in 1890 and was educated at the University of Chicago and Armour Institute of Technology. He entered railway service in 1910 with the Chicago, Milwaukee & St. Paul, where he was employed in surveying parties in Montana, Idaho and Washington. Later he entered the service of the Illinois Central in a similar capacity and in 1912 returned to the C., M. & St. P., as a draftsman and designer in the bridge department at Chicago. In 1914 he became an engineering draftsman for the City of Chicago, and in 1916 entered the service of Fairbanks, Morse & Co., as a designer of reinforced concrete coaling stations. Mr. Mertz entered the service of the Orton Crane and Shovel Company in 1918 as a draftsman and later was promoted to estimator and cost accountant. In December, 1920, he was promoted to assistant secretary, and in June, 1923, was further promoted to secretary and sales manager, which position he was holding at the time of his recent election to vice-president.

J. I. McCants, formerly general sales manager of the Signal Mountain Portland Cement Company, Chattanooga, Tenn., has been appointed Southern sales manager of the Bates Valve Bag Corporation, Chicago, with headquarters at Birmingham, Ala. Mr. McCants, who has been identified with sales in the cement industry since 1905, was for 12 years general sales manager of the Standard Portland Cement Company, Birmingham, Ala., which was later acquired by the Atlas Portland Cement Company. Mr. McCants resigned this position to engage in the retailing of building materials, and subsequently was appointed general sales manager of the Signal Mountain Cement Company.

J. I. McCants

Trade Publications

du Pont History and Development.—In an anniversary number of the du Pont magazine, published by E. I. du Pont de Nemours & Co., Wilmington, Del., there are to be found a large number of interesting facts about the history, development and growth of the company during the past 125 years. This issue also points out clearly the intimate relationship which exists between the many apparently unrelated products manufactured by the du Pont company.

Personal Mention

General

Warren S. Palmer, president and general manager of the Northwestern Pacific, with headquarters at San Francisco, Cal., who is an engineer by training and experience, has retired under the age limit rule. Mr. Palmer was born on April 25, 1858, and graduated from the College of Civil Engineering,

Warren S. Palmer

University of California, in 1876. He entered railway service as an apprentice in the bridge and building department of the Central Pacific (now a part of the Southern Pacific), following which he was promoted successively to journeyman bridge carpenter, draftsman, rodman, transitman and chief of party on location and construction. Between 1885 and 1890 he was in charge of location parties on the Southern Pacific and during a portion of that time was a member of the engineering and contracting firm of Palmer & Storey, San Francisco, Cal., which built several railroads in California. In December, 1890, he was appointed resident engineer maintenance of way of the Western division of the S. P. at Oakland, Cal., serving also as assistant superintendent of the same division from March, 1900, to June 1, 1901. He was promoted to superintendent on the latter date and in September, 1907, was appointed general manager of the Northwestern Pacific, with headquarters at San Francisco. He was elected president of that road in January, 1914, and held the position of president and general manager until the time of his recent retirement, except during the period of federal control, when he was general manager.

Harold W. Legro, acting supervisor of bridges and buildings on the Portland division of the Boston & Maine, with headquarters at Salem, Mass., has been promoted to the newly created position of industrial engineer, with headquarters at Boston, Mass., to act as liaison between the Bureau of Industrial Development and the engineering department. Mr. Legro was born on November 25, 1888, at Lynn, Mass., and entered the service of the B. & M. on June 3, 1907, as a rodman in the engineering department, later serving as transitman, inspector and instrumentman, respectively, in the maintenance and construction departments. On January 1, 1918, he was promoted to assistant track supervisor on the Portland division and on January 15, 1921, was further promoted to assistant division engineer on the same division, with headquarters at Salem, Mass., which position he held until January 16, 1928, when he was appointed acting supervisor of bridges and buildings, on the Portland division, with the same headquarters. Mr. Legro was holding this position at the time of his recent appointment to industrial engineer.

Engineering

W. R. Deterick, assistant engineer on the Missouri Pacific, with headquarters at St. Louis, Mo., has been retired on a pension after 22 years' service with that company.

Guy W. Harris, acting chief engineer of the Atchison, Topeka & Santa Fe System and formerly assistant chief engineer, has been appointed chief engineer of the system, with headquarters at Chicago, to succeed **C. F. W. Felt**, deceased. Mr. Harris was born on March 1, 1878, at Neosho Falls, Kan., and entered railway service in 1898 as a rodman on the Santa Fe Pacific (now the Atchison, Topeka & Santa Fe), at Williams, Ariz. He became a rodman on the A. T. & S. F. at Las Vegas, N. M., in May, 1898, being promoted to transitman at Pueblo, Colo., in 1900 and to assistant engineer at the same point in July, 1903. In January, 1906, Mr.

Guy W. Harris

Harris was made assistant engineer on reconstruction work on the Pecos & Northern Texas and the Southern Kansas of Texas (parts of the Santa Fe system), remaining in this position until March, 1909, when he was promoted to chief engineer of the Pecos & North Texas. He was further promoted to engineer of the Coast lines of the Santa Fe, with headquarters at Los Angeles, Cal., on June 1, 1912, and was made corporate chief engineer of the A. T. & S. F. on July 15, 1918. When the roads were returned to private control on March 1, 1920, Mr. Harris was made assistant chief engineer of the system, which position he retained until November, 1927, when he was appointed acting chief engineer to take the place of Mr. Felt, who was granted a leave of absence on account of ill health.

W. S. Johns, Jr., whose promotion to an engineer maintenance of way in the Western region of the Pennsylvania, with headquarters at Chicago, was noted in the February issue, was born

W. S. Johns, Jr.

on December 27, 1879, at Front Royal, Virginia, and graduated from Lehigh University in 1902. Mr. Johns entered railway service on July 1 of the latter year as a rodman on the Pennsylvania and was promoted to transitman at Altoona on November 15, 1904. He was further promoted to supervisor on the Allegheny division on March 9, 1910, later serving in the same capacities on various other divisions until August 1, 1924, when he was promoted to acting division engineer of the Akron division. On December 1, 1925, he resumed his duties as supervisor on the Eastern region, and on April 1, 1926, was promoted to division engineer of the Monongahela division. On January 16, 1927, Mr. Johns was transferred to the St. Louis division, with headquarters at Terre Haute, Ind., where he was located at the time of his recent promotion to engineer maintenance of way of the Western region with headquarters at Chicago.

Charles L. Bates, whose appointment as maintenance of way engineer of the Pacific Great Eastern was noted in the March issue, was born on June 10, 1880, at Mason City, Iowa, and graduated from the Massachusetts Institute of Technology in 1903. Mr. Bates entered railway service during his summer vacation in 1902 as a draftsman on the Cleveland, Cincinnati, Chicago & St. Louis, and again served as draftsman and inspector on the same road in 1903. From 1904 to 1915, he was resident and assistant engineer on location, construction and maintenance on the Western lines of the Canadian Pacific, entering private practice in municipal

engineering in Saskatchewan in the latter year. In January, 1920, he again entered the service of the Canadian Pacific, as assistant engineer on dock construction at Vancouver, B. C., and from 1921 to 1926 was engineer and superintendent of the Northwestern Dredging Company at Vancouver. Mr. Bates became assistant engineer on the Pacific Great Eastern in March, 1927, in charge of betterments at Squamish, B. C., which position he was holding at the time of his promotion to maintenance of way engineer. The position of chief engineer has been abolished and all engineering matters are now handled by the maintenance of way engineer.

L. M. Swoap, assistant engineer on the Erie at Huntington, Ind., has been promoted to assistant division engineer of the Meadville division, with headquarters at Meadville, Pa., succeeding **R. T. Davis,** who has been transferred to the Susquehanna division at Hornell, N. Y. **J. E. Fletcher,** track supervisor at Decatur, Ind., has been promoted to assistant engineer, with headquarters at Huntington, Ind., to succeed Mr. Swoap.

Herbert B. Hoyt, superintendent of the timber preservation plant of the Buffalo, Rochester & Pittsburgh, with headquarters at Bradford, Pa., has been promoted to division engineer, with headquarters at East Salamanca, N. Y., to succeed **C. H. Griggs,** who has been appointed superintendent of the timber preservation plant at his own request. Mr. Hoyt was born on January 26, 1887, at Wellsville, N. Y., and graduated in civil engineering from Cornell University in 1909. He entered railway service in the same year as a

Herbert B. Hoyt

chainman on the New York Central and later held various positions in the track and engineering branches of the maintenance of way department. In 1916 he became assistant superintendent of the timber preservation plant of the Buffalo, Rochester & Pittsburgh and later was promoted to superintendent. He left railway service in 1921 to engage in engineering work in Colorado and in the following year returned to the service of the New York Central, where he was employed in the bridge and building and track departments. In 1924 he re-entered the service of the B. R. & P. in the track department and in January, 1926, was promoted to superintendent of the timber preservation plant at Bradford, which position he was holding at the time of his recent promotion to division engineer.

John T. Ridgely, whose appointment as engineer maintenance of way of the Long Island, with headquarters at Jamaica, N. Y., was noted in the February issue, was born on June 9, 1887,

John T. Ridgely

at Tyrone, Pa. After graduating from Lehigh University in 1909, he entered the service of the Pennsylvania in the construction department at Johnstown, Pa. On July 1, 1910, he was transferred to the maintenance of way department on the Belvidere division at Trenton, N. J., and later served in various engineering capacities on the same division. On January 1, 1914, he was appointed assistant supervisor on the Conemaugh division at Blairsville, Pa., and later served in the same capacity on the Delaware and Maryland divisions. In 1919 he was promoted to supervisor, with headquarters at Oil City, Pa., and in 1926 was transferred to the Eastern division at Conway, Pa. Mr. Ridgely was promoted to division engineer on January 15, 1927, at Richmond, Ind., and was holding this position at the time of his recent appointment.

George K. Thornton, whose promotion to engineer of track of the Boston & Maine was noted in the March issue, entered the service of the Boston & Lowell in January, 1887, and remained with this company until it was taken into the Boston & Maine. He served as a timekeeper in the construction department, a tie inspector and a work train foreman, respectively, until July 15, 1897, when he was promoted to roadmaster on the White Mountain division. On August 1, 1903, he was transferred to the Eastern division, and in June, 1910, was transferred to the Portland division. On February 1, 1925, Mr. Thornton was transferred to the general office at Boston to act temporarily as engineer maintenance of way, and on January 1, 1926, was appointed assistant to the engineer maintenance of way, which position he held until his recent promotion to engineer of track.

Harry S. Meily, division engineer on the Tyrone division of the Pennsylvania, has retired after over 40 years' service with this company. Mr. Meily entered the employ of the Pennsylvania on September 1, 1887, as a rodman in the construction department, and in September, 1888, was promoted to levelman, serving in this capacity until March 1, 1891, when he was made a transitman. On November 1, 1891, he became a rodman on the Tyrone division and on December 19, 1892, was transferred to the Altoona office. On September 8, 1893, he was promoted to assistant supervisor, and on January 1, 1900, was further promoted to supervisor, serving in that capacity until January 1, 1906, when he became assistant engineer at Buffalo, N. Y. On November 16, 1908, Mr. Meily was promoted to division engineer on the Tyrone division, which position he held until his recent retirement.

Track

C. J. Carney, acting roadmaster on the Vicksburg Route division of the Illinois Central, with headquarters at Vicksburg, Miss., has been promoted to roadmaster, with headquarters at the same point, to succeed **H. J. Rhodes,** who has been appointed assistant engineer.

Olaf Haanes, whose promotion to roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Trail City, S. D., was noted in the March issue, was born on April 23, 1892, at Kristianssand, Norway, and entered railway service in May, 1910, as a section laborer on the Northern Pacific. He was promoted to section foreman in 1912, in which position he served at various points on the Yellowstone division until 1917. He served in the signal corps of the United States Army in 1918, and in 1923 entered the service of the Chicago, Milwaukee & St. Paul (now the Chicago, Milwaukee, St. Paul & Pacific) as an extra gang foreman on the Musselshell division. In May, 1924, he was transferred to the Trans-Missouri division where he served as extra gang foreman and section foreman. Mr. Haanes was section foreman at Stratton, S. D., at the time of his recent promotion to roadmaster.

William Johnson, assistant roadmaster on the La Crosse division of the Chicago, Burlington & Quincy, with headquarters at La Crosse, Wis., has been promoted to roadmaster on the Beardstown division at Virden, Ill., with jurisdiction over the line from Concord, Ill., to Centralia, succeeding **John Debord** who has been transferred to the La Crosse division at La Crosse, with jurisdiction over the line between La Crosse and Savanna, Ill. Mr. Debord succeeds **O. B. Richter** who has been transferred to the Ottumwa division, with headquarters at Ottumwa, Iowa, to take the place of **J. A.**

Lowry who has been transferred to Osceola, Iowa, to assume charge of the new roadmaster's territory which has been created between Des Moines, Iowa, and Cainsville, Mo., and between Indianola Junction, Iowa, and Indianola. **B. A. Terhune,** roadmaster on the Hannibal division, with headquarters at Brookfield, Mo., has been transferred to Craig, Mo., to succeed **W. Perkins,** who has been transferred to Brookfield with jurisdiction over Mr. Terhune's former territory between Brookfield and Hannibal, Mo.

J. O. McGhee, track foreman on the Pennsylvania, has been promoted to acting assistant supervisor on the Monongahela division with headquarters at Monongahela City, Pa., to take the place of **J. C. Oxley,** transferred. **C. J. Henry** has been appointed supervisor on the Eastern division, with headquarters at Wooster, Ohio, to succeed **W. W. Boyer,** who has been transferred to the C. & P. division, with headquarters at Ravenna, Ohio, to succeed **C. P. Willis,** transferred to Wellsville, Ohio, on the same division, to replace **Martin Foley,** who has been appointed maintenance of way inspector of the Lake division. **Frank H. Lewis,** acting supervisor, with headquarters at Lemoyne, Pa., has been appointed supervisor, with the same headquarters, succeeding **E. R. Parke,** who has been transferred to Middletown, Pa. **G. R. Emery,** assistant supervisor at Perryville, Md., has been promoted to supervisor with headquarters at Media, Pa. **R. S. Dunkle,** acting supervisor on the Philadelphia division, with headquarters at Columbia, Pa., has been promoted to supervisor at that point.

Mr. Emery was born on September 27, 1893, at Allegheny, Pa., and after graduating from the University of Pittsburgh in 1915, he entered the service of the Pennsylvania on August 16, 1915, as a chainman on the Conemaugh division. Later he served as a rodman on the Trenton division, and on October 26, 1917, was promoted to assistant supervisor, acting in this capacity successively on the Cresson, Baltimore, Trenton and Maryland divisions, until his recent promotion to supervisor.

Mr. Dunkle was born on January 9, 1894, at Harrisburg, Pa., and was educated at Pennsylvania State College. He entered railway service in June, 1917, in the engineering department of the Pennsylvania and was subsequently appointed acting supervisor, which position he was holding at the time of his recent promotion to supervisor.

Changes on the Erie

With the creation of the position of general roadmaster for each of the three districts comprising the Erie, **J. R. MacAsey,** supervisor, with headquarters at Butler, N. J., has been promoted to general roadmaster of the New York district, with headquarters at New York, **R. M. Cunningham,** supervisor on the New York division, with headquarters at Paterson, N. J., has been promoted to general roadmaster of the Eastern district, with headquarters at Hornell, N. Y., and **H. J. Weccheider,** supervisor on the Buffalo division, with headquarters at Buffalo, N. Y., has been promoted to general roadmaster of the Western district, with headquarters at Youngstown, Ohio. **J. J. Joyce,** section foreman at Ramsey, N. J., has been promoted to supervisor on the Greenwood Lake division, with headquarters at North Newark, N. J., to replace **C. L. Connors,** who has been transferred to the New York division, at Paterson, N. J., to succeed Mr. Cunningham. **W. L. Kelly,** supervisor at Susquehanna, Pa., has been transferred to Buffalo, N. Y., to succeed Mr. Weccheider, and **M. Hopkins,** supervisor at Stroudsburg, Pa., has been transferred to Butler, N. J., to take the place of Mr. MacAsey. **J. J. Keggan, Jr.,** general yard foreman at Hammond, Ind., has been promoted to supervisor, with headquarters at North Judson, Ind., succeeding **W. H. Leatherman,** who has been transferred to Decatur, Ind., to replace **J. E. Fletcher,** whose promotion to assistant engineer, with headquarters at Huntington, Ind., is noted elsewhere in this issue.

Mr. Weccheider was born on May 13, 1898, at Buffalo, N. Y., and entered the service of the Erie on May 8, 1916, as a section laborer at East Buffalo. In April, 1917, he was promoted to section foreman at the same point and served in this capacity until March, 1922, when he was appointed general yard foreman at Susquehanna, Pa. In April, 1923, he was promoted to supervisor of track at Susquehanna, Pa., and in November, 1926, was transferred to Buffalo, which position he held until his recent promotion to general roadmaster of the Western district.

Bridge and Building

Henry Espeland has been appointed supervisor of bridges and buildings on the Northern Pacific, with headquarters at Pasco, Wash., to succeed **E. M. Hull,** resigned.

Purchasing and Stores

C. A. Marshall, stores inspector of the Wabash, with headquarters at St. Louis, Mo., has been appointed division storekeeper on the Central Railroad of New Jersey, with headquarters at Elizabethport, N. J.

Ernest W. Newton, storekeeper of the Gulf, Colorado & Santa Fe, with headquarters at Cleburne, Tex., has been promoted to purchasing agent and storekeeper, succeeding, as purchasing agent, **Thomas O. Wood,** notice of whose death was published in the January issue.

Robert J. Elliott, director of purchases of the Northern Pacific, with headquarters at St. Paul, Minn., retired under the pension regulations of that company on April 1 and the position of director of purchases has been abolished. **C. C. Kyle,** purchasing agent, will continue in his present position and will assume charge of the purchasing and stores departments.

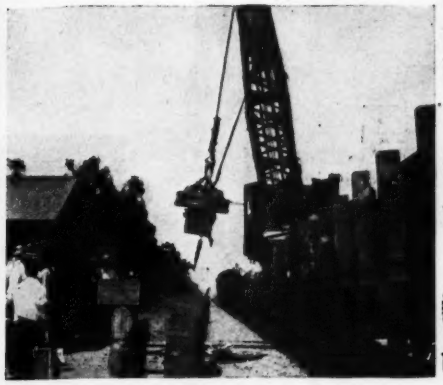
Obituary

John R. Kenly, president of the Atlantic Coast Line, whose early railway training embraced engineering in both the construction and maintenance fields, died at his home in Wilmington, N. C., on March 1 after a brief illness. Mr. Kenly, who was 81 years old at the time of his death and whose railroad career extended over almost 60 years, was born on January 21, 1847, at Baltimore, Md., and served while still a youth with the army of the Confederacy during the last year of the Civil War. He entered railway service

John R. Kenly

in July, 1868, with a surveying party on the Pittsburgh & Connellsville (now a part of the Baltimore & Ohio), and later was promoted to resident engineer on construction, serving in this position until 1871, when he entered the employ of the Union Railroad of Baltimore (now a part of the Pennsylvania) in the same capacity. Two years later he was promoted to engineer and roadmaster and in 1876 to engineer and superintendent. In 1882 he resigned to become superintendent of the Richmond & Petersburg, one of the predecessors of the present Atlantic Coast Line. He was advanced to superintendent of transportation of the Atlantic Coast Line in 1885 and to assistant general manager in 1889. In 1891 he was further advanced to general manager, being made also fourth vice-president in 1902. He was elected third vice-president in 1905 and in 1913 was elected president, which position he retained until the time of his death.

Sullivan Auger Rotator.—The Sullivan Machinery Company, Chicago, has issued Bulletin 81-0 describing its auger rotator, class H-8, for drilling in soft, broken or loose ground, where the ordinary air hammer drill would become clogged. The construction of the rotator is described in detail and the dimensions and weights are given in tabular form.



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